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(54) LIQUID CRYSTAL DISPLAY DEVICE AND ITS DRIVING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent picture quality deterioration such as crosstalk.
SOLUTION: A display area is divided into (n) subfields for displaying one frame image in order along the time base, and the said subfields consist basically of A÷×m pixels or scanning lines [where A is a positive integer, (n) is a positive integer between 3 and A, and (m) is a positive integer less than (n)]. This driving method of the liquid crystal display device drives a selected scanning line with the same polarity with a pixel group arranged on the same scanning line, inverts the said polarity to compensate a flicker, and selects the said pixel or scanning line in the subfield at a, specific interval.

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1]A substrate of a couple which has a switching element which chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, A liquid crystal material pinched between substrates of said couple, and a driving means made to drive with the same polarity about a selected scanning line to a pixel group arranged to the same scanning line, A polarity-reversals means to reverse said polarity and to compensate a flicker is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). A liquid crystal display constituting a positive integer as for A, and, as for n, 3 - a positive integer of A, and m comprising fundamentally a pixel or a scanning line of a positive integer individual below n, and choosing said pixel or a scanning line at the predetermined intervals in said subfield.
[Claim 2]The liquid crystal display according to claim 1 which an interval of said pixel chosen in said subfield or a scanning line is made the same between each subfield, and makes inharmonious a cycle which reverses said polarity for each pixel or a scanning line to selection or a cycle which makes non selection.
[Claim 3]The liquid crystal display according to claim 2 a polar inversion cycle is made to differ between each subfield.
[Claim 4]The liquid crystal display according to claim 1 which changes and displays an interval of said pixel chosen in said subfield, or a scanning line according to a cycle of said polarity reversals.
[Claim 5]The liquid crystal display according to claim 1 make inharmonious an interval of said pixel chosen in said subfield, or a scanning line to a cycle of said polarity reversals, and an interval of said pixel chosen between each subfield or a scanning line is made to differ.
[Claim 6]A substrate of a couple which has a switching element which chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, A liquid crystal material pinched between substrates of said couple is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). It is a drive method of a liquid crystal display for which a positive integer is constituted as for A and, as for n, 3 - a positive integer of A, and m comprise fundamentally a pixel or a scanning line of a positive integer individual below n, A drive method of a liquid crystal display making it drive with the same polarity to a pixel group arranged to the same scanning line, reversing said polarity, compensating a flicker, and choosing said pixel or a scanning line at the predetermined intervals in said subfield about a selected scanning line.
[Claim 7]A drive method of the liquid crystal display according to claim 6 which an interval of said pixel chosen in said subfield or a scanning line is made the same between each subfield, and makes inharmonious a cycle which reverses said polarity for each pixel or a scanning line to selection or a cycle which makes non selection.
[Claim 8]A drive method of the liquid crystal display according to claim 7 a polar inversion cycle is made to differ between each subfield.

[Claim 9]A drive method of the liquid crystal display according to claim 6 which changes and displays an interval of said pixel chosen in said subfield, or a scanning line according to a cycle of said polarity reversals.
[Claim 10]A drive method of the liquid crystal display according to claim 6 make inharmonious an interval of said pixel chosen in said subfield, or a scanning line to a cycle of said polarity reversals, and an interval of said pixel chosen between each subfield or a scanning line is made to differ.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a liquid crystal display in which the switching element for selection was allocated for every pixel or every scanning line, and a drive method for the same.
[0002]
[Description of the Prior Art]Since the liquid crystal display is lightweight at a thin shape and the low voltage drive is possible for it, it begins a wrist watch and a calculator and is widely used for the word processor, a personal computer, a small game machine machine, etc. These days, the demand of pen input electronic notebooks increases and the demand to a portable terminal (PDA) is expanded in connection with this.
[0003]When making a liquid crystal display drive, in the same screen, there is a drive method which reverses polarity and to this drive method. The signal wire reversal which reverses polarity for every signal wire, the horizontal polarity reversals (it is hereafter called H reversal) which reverse polarity for every scanning line, and the dot inversion which reverses polarity between the adjoining pixels are mentioned. These drive methods can compensate the flicker ingredient (for example, field flicker) by polar reversal. In particular, H reversal is widely used increasingly by demand to the low resisting pressure driver for single-sided arrangement of the signal wire driver accompanying narrow-picture-frame-izing, and also low power consumption.
[0004]
[Problem(s) to be Solved by the Invention]In a big screen and LCD which becomes highly minute, the number of signal wires increases and the capacity component between a common electrode and a signal wire becomes large. According to the distance from the feeding point, a resistance component changes with the sheet resistance of a common electrode a lot. For this reason, since the damping time constants of a common electrode differ in a screen as shown in drawing 19 when the polarity reversals of a common electrode are performed, variation (a waveform becoming blunt) arises in the pressure value of a common electrode. When it displays on a window, this serves as image quality deterioration well known as a cross talk, in order to be dependent on a signal level. Although it is possible as a method of solving this to usually lower the sheet resistance of a common electrode, there is a limit in this method and it is not enough.
[0005]This invention is made in view of this point, and is a thing.
The purpose is to provide a liquid crystal display which can prevent the image quality deterioration of **, and a drive method for the same.

[0006]
[Means for Solving the Problem]A substrate of a couple which has a switching element from which this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one

substrate, A liquid crystal material pinched between substrates of said couple, and a driving means made to drive with the same polarity about a selected scanning line to a pixel group arranged to the same scanning line, A polarity-reversals means to reverse said polarity and to compensate a flicker is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). As for A, a positive integer is constituted, as for n, 3 - a positive integer of A, and m comprise fundamentally a pixel or a scanning line of a positive integer individual below n, and a liquid crystal display choosing said pixel or a scanning line at the predetermined intervals in said subfield is provided.

[0007]A substrate of a couple which has a switching element from which this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, A liquid crystal material pinched between substrates of said couple is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). It is a drive method of a liquid crystal display for which a positive integer is constituted as for A and, as for n, 3 - a positive integer of A, and m comprise fundamentally a pixel or a scanning line of a positive integer individual below n, It is made to drive with the same polarity to a pixel group arranged to the same scanning line about a selected scanning line, said polarity is reversed, a flicker is compensated, and a drive method of a liquid crystal display choosing said pixel or a scanning line at the predetermined intervals in said subfield is provided.

[0008]

[Embodiment of the Invention]In a liquid crystal display and a drive method to this invention, When a picture is displayed with A pixels or scanning line by which the switch INGU element for selection was allocated in each, It divides into n subfields which display the frame image of one sheet in order along with a time-axis, and is said subfield Said two or more pixels or A/nxm (here) of the scanning lines A constitutes a positive integer and n constitutes the positive integer below A, and m fundamentally with the pixel or scanning line of a positive integer individual below n or more from three.

[0009]In order to improve image quality, it is made for the scanning line group which serves as different polarity as much as possible from the scanning line which writes in, and the scanning line of that neighborhood, and serves as the same polarity adjacently to serve as the minimum in this composition.

[0010]When displaying a picture with a scanning line, interlace processing of the picture signal of the frame image of one sheet is carried out to n:m, and said switching element is made to choose and drive according to this processed picture signal. Since the selection frequency of a scanning line is reduced according to this drive method and the multi-field driving method, low power consumption is realized, and the flicker ingredient (for example, field flicker) by reversal of each polarity can be compensated with that selection method.

[0011]Have the above-mentioned composition, namely, according to this invention which adopts H reversal and a multi-field drive simultaneously. Since the voltage of a common electrode rises, and it becomes blunt, when the real row voltage to a pixel changes with picture signals, by reversing the polarity of a common electrode before the selection period of a scanning line, Since writing operation is performed after the voltage of a common electrode has risen thoroughly, distribution of voltage in the screen of the common electrode depending on a picture signal can always be made uniform, and the image quality deterioration by a cross talk can be improved substantially. Since it synchronizes with a polar inversion cycle, ON time of a gate line is lengthened and the write time to a picture element electrode can be lengthened, the write-in characteristic to a picture element electrode can be raised.

[0012]When this H reversal and a multi-field drive are used simultaneously, and a polar inversion cycle and the selection cycle of a scanning line synchronize, it may become a situation which adjoins over two or more scanning lines, and is displayed with the same polarity, and a disk may arise in a display. In order to change that position along with a time-axis, this same adjoining polar

scanning line group becomes what is not a stationary thing and moves, and when it goes into the field recognized visually with the visual frequency characteristic between space-time, it will be produced as large image quality deterioration.

[0013]In a high definition picture which does not have correlation in a picture, a flicker ingredient is no longer compensated and distortion may arise by return according to the difference of the flicker ingredient. Since it becomes what is not a stationary thing and moves also about this clinch distortion, when it comes into the field recognized visually with the visual frequency characteristic between space-time, it is made for image quality deterioration to be produced substantially.

[0014]In a multi-field drive, since a maintenance period becomes large substantially, the flicker ingredient for every scanning line becomes large. Therefore, the line disturbance produced for every subfield will be recognized visually, and there is a problem which causes the image quality deterioration of a still picture.

[0015]In order to prevent degradation of the image quality by such line disturbance and disk disturbance, and clinch distortion which originates in it further, it is made the field which is not recognized visually by the visual frequency characteristic between space-time by the following means.

[0016]The interval of the pixel chosen in a subfield as the 1st means or a scanning line is made the same between each subfield, and the cycle which reverses polarity for each pixel or a scanning line to selection or the cycle which makes non selection is made inharmonious.

[0017]A polar inversion cycle is made to differ between each subfield in the 1st means as the 2nd means (it is made not the same).

[0018]That is [as the 3rd means it changes and displays the interval of said pixel chosen in a subfield, or a scanning line according to the cycle of polarity reversals], selection or the cycle which makes non selection is made inharmonious for each pixel or a scanning line to the cycle of polarity reversals. The interval of the pixel chosen in a subfield or a scanning line may be made the same between each subfield.

[0019]As the 4th means, the interval of the pixel chosen in a subfield or a scanning line is made inharmonious to a polar inversion cycle, and the interval of the pixel chosen between each subfield or a scanning line is made to differ. In a subfield, a polar inversion cycle may be made the same between each subfield.

[0020]According to the 1st means, with the polar inversion cycle which compensates a flicker, even if it becomes at least the scanning order which is easy to produce image quality deterioration, a polar inversion cycle can be changed selectively and image quality deterioration can be improved substantially.

[0021]According to the 1st and 3rd means, it becomes that it is not applied to the field which the scanning line group which adjoins spatially and serves as the same polarity does not arise, or is recognized visually by vision characteristics, or is hard to be recognized visually. In the 1st and 3rd means, since a picture is displayed with a scanning line, when interlace processing of the picture signal is carried out to n:m, the number of scanning lines which serves as the same polarity adjacently between the scanning lines which adjoin in one frame can be made below into n. Therefore, the flicker (luminance difference) accompanying write-in polarity does not have periodicity spatially in a panel surface, or the spatial frequency in a panel surface becomes high. For this reason, it becomes that the same polarity group (disk) resulting from the polar inversion cycle and the selection cycle of the switching element of a multi-field drive having synchronized, for example is not applied to the field recognized visually by vision characteristics, or is hard to be recognized visually, and image quality deterioration can be improved substantially.

[0022]When it generates on a spatial frequency axis as a career with a new flicker accompanying write-in polarity and distortion arises by return by it in a high definition picture which does not have correlation in a picture, also about this clinch distortion. Since the spatial frequency in a panel surface becomes high or it does not have periodicity spatially, it becomes that it is not applied to

the field recognized visually by vision characteristics, or is hard to be recognized visually, and degradation of image quality can be improved substantially.

[0023]Since the election priority of a scanning line is selectively changeable even if it becomes a polar inversion cycle which is easy to produce image quality deterioration depending on selection or the cycle which makes non selection of a scanning line according to the 3rd means, image quality deterioration is substantially improvable.

[0024]According to the 2nd and 4th means, when a flicker cannot be compensated depending on one certain method, it can carry out that it is hard to be recognized visually by migrating to two or more subfields and changing selection or the cycle which makes non selection of a polar inversion cycle and a scanning line. These one method and 2nd and 4th means can also be used simultaneously. When compensating the flicker produced according to polar reversal, common voltage can also perform, but flicker compensation may be more effectively performed by changing said common voltage according to a polar inversion cycle.

[0025]According to the 2nd and 4th means, a polar inversion cycle is made at least for scanning order to differ for every subfield group, by a certain fixed method, it is not recognized visually by vision characteristics or the flicker and disk flow which may be produced can be carried out that it is hard to be recognized visually.

[0026]In the liquid crystal display of this invention, the kind in particular of the material of a substrate or liquid crystal material is not restricted.

[0027]Hereafter, an example is concretely described for this invention with reference to drawings.

[0028](Example 1) Each following example applies the multi-field driving method which lowers drive frequency by dividing one frame (frame image of one sheet) into two or more subfields. Since the multi-field driving method is indicated in JP,3-271795,A, the detailed explanation is omitted.

[0029]In Example 1, the interval of the pixel chosen in a subfield or a scanning line is made the same between each subfield, and the case where a polar inversion cycle is made inharmonious is explained to the cycle of selection of a pixel or a scanning line, or non selection.

[0030]Drawing 1 is a schematic diagram showing the composition of the important section of the liquid crystal display of this invention. Drawing 2 is a figure showing the input picture signal and inversion signals at the time of using a multi-field drive, n= 3, m= 1 (the number of subfields is 3/1=3), and H reversal. The liquid crystal display of this invention The inversion-signals generating part 10 and the common voltage outputting part 11, It mainly comprises the liquid crystal display panel 12, the gate line driving circuit 13, the n:m interlace processing circuit 14, the n counter circuit 15, the signal wire driver 16, and the scanning line selection signal generation circuit 18. The liquid crystal display panel 12 comprises a liquid crystal material pinched between the substrate of the couple which has a switching element which chooses a pixel or a scanning line and a pixel, or a scanning line on at least one substrate, and the substrate of a couple.

[0031]In the liquid crystal display of the above-mentioned composition, as shown in drawing 2, in a certain subfield, one scanning line is chosen as three every two by the scanning line selection signal S1, and the scanning line under one of the selected scanning lines is chosen one by one in a similar manner in the next subfield. The portion which attached the diagonal line shows the scanning line selected in each subfield among drawing 2. Here, the polarity at the time of the polarity of the non selection scanning line which does not attach the diagonal line choosing each scanning line at the end is maintained. A slash part shows + polarity and a plain part shows - polarity.

[0032]In the drive method of this invention, in order to change a polar inversion cycle according to the election priority of a scanning line, the scanning line selection signal S1 is inputted into the inversion-signals generating part 10 and the gate line driving circuit 13 from the scanning line selection signal generation circuit 18. At this time, the n counter circuit 15 outputs the start pulse to a gate line driver for every field, and is inputted into the count signal S2 ** gate line driving circuit 13 from the n counter circuit 15. The gate line of the scanning line of a switching element drives with this scanning line selection signal S1 and count signal S2.

[0033]On the other hand, the inversion signal P1 which shows a polar inversion cycle is inputted into the n:m interlace processing circuit 14 and the common voltage outputting part 11 from the inversion-signals generating part 10. The inversion signals P1 had reversed polarity for every scanning line and every field, in order to compensate a flicker. It is processed in the n:m interlace processing circuit 14, that signal is inputted into the signal wire driver 16, and this inputted inversion signal P1 reverses the polarity of the signal wire of the liquid crystal display panel 12 based on that signal. This inputted inversion signal P1 reverses the polarity of the common voltage of the liquid crystal display panel 12 via the common voltage outputting part 11.
[0034]The following effects are acquired by such a drive method.
[0035](1) In H inversion driving, since the inversion operation for every scanning line in high frequency is usually needed, it is necessary to design a driver so that current may flow enough at the moment of being reversed. After making it once shift to high potential at the time of reversal, it is made to drive conventionally using the driver who, on the other hand, enlarged current gain from a direction, for example, the driver which made current easy to flow through into - side from + side. This operating becomes unnecessary or it becomes unnecessary to send current greatly by combining H inversion driving and a multi-field drive at the time of reversal. For this reason, since timing of writing can be made late, the driver in which high-speed operation is possible becomes unnecessary.
[0036](2) In H inversion driving, the polarity of a driver becomes the same [every signal wire]. Therefore, since the signal (adjustment signal) given from D0 serves as the same polarity in that time then, it will enlarge an effect at the polarity (+ or -) of **. For example, - writing usually has bad maintenance to + writing. Therefore, maintenance of - writing can be made good by making an adjustment signal - slippage. In this case, although it is possible that maintenance of + writing worsens, image quality is improvable by making holding property of amphipathy equivalent.
[0037](3) There is a phenomenon "thrust to one of the causes of image quality deterioration", and when gate voltage falls at the time of the switching OFF of TFT (ThinFilm Transistor), as for this, change pixel potentials by coupling by parasitic capacitance.
[0038]Since this amount of change differs in how whose gating signal becomes blunt by screen right and left (it follows for separating (it goes to the wave-like right), and it becomes blunt, although the neighborhood of a gate driver is sharp), it changes with screen right and left. Therefore, in order to improve this, by screen right and left, an inclination can be attached and the size of D0 can be given.
[0039](4) The switching characteristic of TFT is determined by the ON voltage and OFF voltage of gate voltage. Since the polarity of the pixel which adjoins that it is signal wire inversion driving differs, ON voltage and OFF voltage cannot be decided according to each polarity. In the case of H inversion driving, this becomes possible, but since the inversion driving cycle is usually short, power will be consumed if voltage is shifted at every time.
[0040]Since the inversion driving cycle will be 4 times the H inversion driving by combining H inversion driving and a multi-field drive, according to each polarity, ON voltage and OFF voltage can be decided good, and, thereby, image quality can be improved.
[0041]When performing scanning line selection and reversal as shown in drawing 2, in order to migrate to three subfields and to scan to line sequential, a front scanning line and the following scanning line serve as the same polarity. Therefore, when the 1 field comprises the subfields SF11-SF13 of three sheets, image quality may be degraded as what is called a disk flow that three scanning line groups which the same polarity adjoins move.
[0042]Then, next, the case where it displays by changing the polar inversion signal P1 according to a scanning line selection signal is explained.
[0043]With the signal S1 received from the scanning line selection signal generation circuit 18, from an inversion-signals generating part, they are made by the inversion signals P1 in this example, and in the n:m interlace processing circuit 14, The output control of the picture information used as the

picture information chosen according to S1 and non selection is performed, and conversion of picture information is performed by P1. Although there is no restriction in particular in the contents of processing performed by the n:m interlace processing circuit 14, they are the contents of processing for improving degradation of a display image.

[0044]There is no restriction in particular about conversion of picture information, and about the case where a signal level is determined, for example according to reversal of common voltage, also in the same gradation, conversion is performed so that it may be set to the signal level which differs in + writing and - writing. For example, when the liquid crystal cell which shows a voltage-transmittance curve as shown in drawing 3 is used, in + writing, the transmissivity of T1 will be shown to the signal level of V2, and - writing will show the transmissivity of T1 to the signal level of V1.

[0045]In this example, a picture signal is a digital signal and within the signal wire driver 16 Digital to analog. It is performing (it is hereafter called D/A), the picture signal (referred to as DV1 and DV2, respectively) of V1 and V2 serves as a following formula, and an input picture signal and a polar inversion signal are outputted corresponding to 1:1.

[0046]

[Equation 1]

$$DV1 = \overline{DV2}$$

[0047]In this case, polar inverting means are changed and there is the necessity (here, denial is taken) of also changing an input picture signal. For example, exclusive OR is taken between inversion signals (P0) and the inversion signals (P1) which performed processing which improves degradation of a display image, a picture signal is denied in one state, and the output to the signal wire driver 16 is performed. Drawing 4 (A) shows the contents of processing currently performed in the n:m interlace processing circuit 14, and drawing 4 (B) shows the signal wave form of each part. Although the contents of processing in particular in drawing 4 (A) are not restricted, it has the selector 31 and the selector 32, for example, In the selector 31, the picture signal D1 or D0 is chosen with a scanning line selection signal, and a picture signal inverted output is chosen by the exclusive OR of P0 and P1 in the selector 32.

[0048]Here, actually, although D0 is a signal which is not written in, it is a signal required in order to amend by applying a certain voltage to an organization which has not been chosen to a signal wire. In this case, although what kind of thing D0 may be, what improves image quality through coupling (capacity) between a signal wire and a pixel is preferred. Therefore, D0 can also be made into the same signal as D1.

[0049]In the above-mentioned explanation, although a case where reversal of write-in polarity and a picture signal was in agreement was described, in a voltage-transmissivity characteristic, it may change into a suitable picture signal for every polarity by providing a reference part which can compare each signal-level value and picture signal information.

[0050]In this invention, a disk flow into which a scanning line group which makes the minimum a scanning line group which serves as the same polarity adjacently, or serves as the same polarity flows can make it be hard to be recognized visually by combining two methods, a polarity-reversals method and a selection method of a scanning line.

[0051]Drawing 5 shows a picture displayed on a liquid crystal display panel by signal concerning a drive method of this invention, and its signal. A portion which a slash part showed + polarity among drawing 5, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0052]Here, it is a case where n= 4 and m= 1 (the number of subfields is 4/1=4) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating

part 11 can be reduced. A scanning line under one which makes a polar inversion cycle every four scanning lines, and chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum, and so that it may become upper scanning line and reverse polarity. Even when a multi-field drive is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high.

[0053]Here, since it is necessary to compensate between scanning lines when using the multi-field driving method, two or more polar biases become important. For example, in this example, a compensation relation to a problem in every four becomes, and a scanning line group toward which polarity inclines at a rate of 3:1 exists in drawing 5. However, a disk flow becomes one 3 times the flowing velocity of this, and this scanning line group becomes in the following field that it is hard to be recognized visually in order to move by 3 pixels. Although especially this drive method is effective in a 2n:1 (n>=2) multi-field drive, it is not restricted to the above-mentioned example.

[0054]Drawing 6 shows an example of change of an inversion cycle of drawing 5, and shows a picture displayed on a liquid crystal display panel by signal which starts a drive method of this invention like drawing 5, and its signal. Here, the polarity of a scanning line is unified all over a subfield, and it is considered as a cycle reversed for every subfield. A portion which a slash part showed + polarity among drawing 6, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0055]Here in a multi-field drive, n= 5, m= 1. (however, the number of subfields is a case where 5) is used, also in this case, can reduce drive frequency and can reduce power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 similarly. All over a subfield, since common voltage is maintained at fixed voltage (+ polarity or - polarity), in the signal wire driver 16, the liquid crystal display panel 12, and the common voltage generating part 11, a reduction effect of power consumption becomes large more. However, in this method, since + writing and - writing are performed on the whole screen, generating of a field flicker can be considered.

[0056]Then, as shown in drawing 7 (A) and (B), carry out double-speed processing of the inputted image information, and a data constellation of the following subfield is recorded on a memory, and a data constellation of a subfield of another side is written in by SF1. For example, about writing in this case, it carries out with + polarity. Then, said subfield and polarity are reversed and writing of a data constellation recorded on said memory is written in throughout [two SF] with - polarity. Since this subfield period is performed by period of a half of the usual multi-field drive, a field flicker goes into a high frequency domain, and is not recognized visually. In this case, although power consumption in a clock part of the gate line driving circuit 13 increases, since power consumption in the common voltage generating part 11 is reduced substantially, as the whole, power consumption becomes low.

[0057]A memory may be provided in the n:m interlace processing circuit 14 shown in drawing 1, and the above-mentioned processing may be performed using the memory. Here, in order to explain simply, are not describing a gap in particular of timing of a signal by buffer in the n:m interlace processing circuit 14 and a buffer within a signal wire driver, but. Timing with a scanning line is coincided so that a desired picture may be acquired actually.

[0058]Although an increase in the number of ICs by having a memory and an increase in power consumption are expected, as shown in drawing 8, it can have composition which does not have a memory in a module by controlling a signal output from the computer side which outputs a signal. Usually, in an information terminal body, a signal output to a module is controlled by Video RAM 21 and the control circuit 22. In this example, in order to change an inputted image according to a processing means of a n:m interlace, the scanning line selection signal S1 of a modular circuit is

inputted into this control circuit 22 from the scanning line selection signal generation circuit 28. And the control circuit 22 will change specification of an address and output timing of a picture between Video RAMs 21. In drawing 8, the reference numbers 23-27 show a liquid crystal display panel, a n:m interlace processing circuit, a signal wire driver, n counter circuit, and a gate line driving circuit, respectively, and these functions of them are the same as that of a case where it is shown in drawing 1.

[0059]Since an inversion cycle of common voltage can be substantially made low, a standup of common voltage in the time of polarity reversals can be prevented from becoming a problem in this example. That is, in order for what is necessary to be just to reverse the polarity of common voltage during a blanking period, a comparatively long damping time constant of common voltage at the time of writing will be taken. Therefore, sheet resistance of a counterelectrode can enlarge. Or the feeding point can be lessened.

[0060]When carrying out double-speed processing of the 2n+1:1 (n>=1) multi-field drive, although the above-mentioned drive method is effective, it is not restricted in particular to the above-mentioned example.

[0061](Example 2) In Example 2, an interval of a pixel chosen in a subfield or a scanning line is made the same between each subfield, and make a polar inversion cycle inharmonious to a cycle of selection of a pixel or a scanning line, or non selection, and let a polar inversion cycle be different [1] also between the fields.

[0062]Drawing 9 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 9, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0063]Here, in a multi-field drive, it is n= 5 and m= 2 (although the number of subfields is set to 2.5). it is constituted by subfield of three sheets as a display image -- **** -- it is a case where it uses, and drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced. In this case, reversal which makes polar inverting means the same polarity every every three scanning lines and 2 scanning lines is performed by turns, and a scanning line under one which chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum and it may become upper scanning line and reverse polarity. Even when the multi-field driving method is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high.

[0064]However, in this method, since + writing and - writing incline and exist at a rate of 3:2 in a screen, it is expected that a dc component is impressed to a liquid crystal material and an orienting film. Then, a rate of the number of scanning lines of + writing and - writing is switched for every number subfield. In this case, although it is thought that there is a possibility that a field flicker at the time of a change may be recognized visually, image quality deterioration can be reduced by lowering to below change frequency (for example, 1 [Hz]) that is not recognized visually with vision characteristics. It may be made to output common voltage which becomes the optimal according to a polar bias from the common voltage generating part 11.

[0065]Drawing 10 shows an example of change of a selection method of a scanning line of drawing 9, and shows a picture displayed on a liquid crystal display panel by signal which starts a drive method of this invention like drawing 9, and its signal. In a drive method shown in drawing 10, two scanning lines are not continuously driven all over a subfield. A portion which a slash part showed + polarity among drawing 10, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0066]It is [in / here / a multi-field drive] n= 5 and m= 2 (although the number of subfields is set to 2.5). it is constituted by subfield of three sheets as a display image -- **** -- it is a case where it uses, and drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced. Reversal which makes polar inverting means every three scanning lines and the polarity same [two whole scanning lines] also in this case is performed by turns, and a scanning line under one which chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum and it may become upper scanning line and reverse polarity.
[0067]Even when the multi-field driving method is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high. In this method, although + writing and - writing incline and exist at a rate of 3:2 with every scanning line, it is equalized in a screen and it is possible that a dc component is not impressed by an orienting film compared with a case of drawing 9.
[0068]A rate of the number of scanning lines of + writing and - writing may be switched for every number subfield like a case where it is shown in drawing 9 also in this case. Although especially this drive method is effective in a 2n+1:2 (n>=1) multi-field drive, it is not restricted to the above-mentioned example.
[0069](Example 3) In Example 3, an interval of a pixel chosen in a subfield or a scanning line is changed to a polar inversion cycle.
[0070]Drawing 11 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 11, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.
[0071]Here, it is a case where n= 6 and m= 2 (the number of subfields is 3) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced.
[0072]When this drive method is used, a portion from which the number of scanning lines which serves as the same polarity adjacently does not become [this / below / n] arises. However, since an interval of a disk changes and a disk flow is also lost as shown in drawing 11, a space spectrum of a disk becomes that it distributes and is hard to be recognized visually, and is simultaneously effective also to distortion by return.
[0073](Example 4) In Example 4, an interval of a pixel chosen in a subfield or a scanning line is changed to a polar inversion cycle, and it is considered as different [1] between each subfield.
[0074]Drawing 12 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 12, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.
[0075]Here, it is a case where n= 3 and m= 1 (the number of subfields is 3) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced.
[0076]In this drive method, an election priority of a scanning line is made the same by SF1-SF6, and + polarity and - polarity are reversed between subfields. It is made an election priority which is different from the above by SF7-SF12 continuing, and polarity is reversed between subfields. SF13-SF18 were performed similarly, and an election priority of a scanning line has included a portion which does not become the same. By doing in this way, it can carry out to a disk or a disk flow

produced when it drives by a certain fixed election priority that it is hard to be recognized visually.
[0077](Example 5) Example 5 is an application which raises image quality by changing a polarity-reversals method during a maintenance period in each of above-mentioned examples.
[0078]In a multi-field drive, in order that a period which makes non selection of the scanning line may not perform writing operation, even if it changes signal line voltage and common electrode voltage, a picture element electrode is in floating theoretically, and, for this reason, an electric field concerning a liquid crystal layer is kept constant. However, actually, leakage current occurs and picture element electrode potential changes with the switching characteristics of TFT and the characteristics of a liquid crystal material which are switching elements. In this case, pixel-potentials change and a luminance change by leak are improvable by controlling polarity reversals in a maintenance period.
[0079]Here in a multi-field drive, are a case where n= 4 and m= 1 (the number of subfields is 4/1=4) are used, and usually at the time of - writing the holding property of (-), + Since leakage current is large compared with the holding property of (+) at the time of writing, as shown in drawing 13, voltage at the time of - writing is made to be impressed to a signal wire, concerning polarity in a maintenance period. In this figure, in order to make it intelligible, the signal wire Xn and a pressure value impressed to Xn+1 have shown voltage to common potential (Vcom). Although there is no restriction in particular about the pressure value V0 in this case, it is preferred to make it holding property at the time of + writing and - writing become equal.
[0080]In this case, as processing, the scanning line selection signal S1 is inputted into the signal wire driver 16, and it carries out by outputting V0 made within the signal wire driver 16 in a non selection period to a signal wire. V0 may be given based on D0. In order to raise not only this example but a switching characteristic in a maintenance period, various polar inversion cycles in a maintenance period are changeable.
[0081]In order to improve wave-like **** at the time of a standup by resistance of a common electrode being high and a damping time constant becoming long about the polarity of common voltage, As shown in drawing 14, at the time of writing, a waveform of common voltage can be performed in the state where it rose thoroughly, by making it during the maintenance reversed to polarity at the time of the next writing. For example, as shown in drawing 15 (A), when it displays on a window, as shown in drawing 15 (B), a portion from which contrast differs in window right and left arises, and image quality deterioration by a cross talk arises.
[0082]For example, when black is displayed in a window and intermediate color is displayed outside a window, intermediate color of window right and left becomes bright compared with a portion outside of it. This is because it is with a scanning line selection period without a window, and a scanning line selection period with a window and a wave-like standup of common voltage changes with capacity coupling between a signal wire and a common electrode, as shown in drawing 19. For this reason, at the time of writing, a difference arises in real row voltage to a picture element electrode, and it is thought that a cross talk appears. Since according to this example polarity reversals of common voltage are enough performed early from usual as shown in drawing 16, a wave-like standup of common voltage is not affected. Therefore, a cross talk can be eliminated and image quality can be improved substantially.
[0083]This example is not restricted to a 4:1 multi-field drive, and can be applied to all the n:m multi-field drives. Here, a case where a drive method of this example is applied to Example 2 which performs writing operation of 2LINE continuously is explained.
[0084]When performing writing operation continuously, it is thought that there is no beforehand reversed period about reversal with a common electrode in a write period of the following scanning line (drawing 17 (A)). Also in this case, timing of selection of a scanning line can be carried out by making it shown in drawing 17 (B). In this case, in a gate line driving circuit, it is assumed that it has the function to change timing of a shift register. In drawing 17 (B), after stopping a clock after choosing a scanning line before changing timing and being continuously chosen with a clock, and

performing polarity reversals and common voltage fully rises, a clock is re-operated and a signal is shifted. A scanning line after being chosen continuously is chosen by carrying out an ON signal with a scanning line selection signal with this. After that, it is usually alike, and with a more nearly high-speed clock signal, a shift action is performed and it doubles with selection operation of the following scanning line.

[0085]It can be made to be able to synchronize with a polar inversion cycle, and a write period can also be lengthened. For example, as shown in drawing 18 (B), by making a selection period of a scanning line longer than usual, the write-in characteristic can be raised and image quality can be improved substantially. In this case, suppose that processing in the scanning line selection signal generation circuit 18 and the gate line driving circuit 13 is shown, for example in drawing 18 (A).

[0086]Here, it is explaining in the 4:1 multi-field driving method. That is, from a scanning line selection signal, the four scanning line selection signals S10, S11, S12, and S13 are outputted, and each performs an output control of the scanning line G4n, G4n+1, G4n+2, and G4n+3. In this case, a signal from S2 is outputted as a signal which has 4 times as many scanning line selection periods to a signal at the time of only combining a multi-field drive and H reversal. Here, from the signal wire driver 16, a signal which displays a desired picture shall be outputted to a signal wire.

[0087]In the range which is not limited to the above-mentioned example and does not deviate from the gist, it changes variously and this invention can be carried out.

[0088]

[Effect of the Invention]The substrate of the couple which has a switching element from which the liquid crystal display of this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, The liquid crystal material pinched between the substrates of said couple, and the driving means made to drive with the same polarity about the selected scanning line to the pixel group arranged to the same scanning line, A polarity-reversals means to reverse said polarity and to compensate a flicker is provided, a viewing area is divided into n subfields which display the frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). Since a positive integer is constituted as for A, as for n, 3 - the positive integer of A, and m comprise fundamentally the pixel or scanning line of the positive integer individual below n and said pixel or a scanning line is chosen at the predetermined intervals in said subfield, image quality deterioration, such as a cross talk, can be prevented.

[0089]According to this invention, by not synchronizing the cycle of selection of a pixel or a scanning line, or non selection, and the cycle of polarity reversals, the number of the pixel which serves as the same polarity adjacently, or scanning lines can be done small, and the disk disturbance resulting from it can make it be hard to be recognized visually. Since a disk will not flow along with a time-axis, image quality is substantially improvable from vision characteristics.

[0090]According to this invention, the power consumption in a common electrode can be reduced substantially, without degrading image quality by performing writing operation by the usual double speed, and performing polarity reversals for every subfield.

[0091]According to this invention, the leakage current by TFT and a liquid crystal layer is controlled by changing the inversion cycle in a maintenance period, and it is + writing. - Holding property which writes in and comes out can be made equal, and image quality can be improved substantially. In a common electrode, since writing operation can be performed after the common electrode has risen on desired voltage by making it during the maintenance reversed to the polarity at the time of the next writing, the write-in characteristic can be optimized and image quality can be improved substantially.

[0092]According to this invention, by taking a long write period according to a polar inversion cycle, the write-in characteristic to a picture element electrode can be raised, and image quality can be improved substantially.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention]This invention relates to a liquid crystal display in which the switching element for selection was allocated for every pixel or every scanning line, and a drive method for the same.

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EFFECT OF THE INVENTION

[Effect of the Invention]The substrate of the couple which has a switching element from which the liquid crystal display of this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, The liquid crystal material pinched between the substrates of said couple, and the driving means made to drive with the same polarity about the selected scanning line to the pixel group arranged to the same scanning line, A polarity-reversals means to reverse said polarity and to compensate a flicker is provided, a viewing area is divided into n subfields which display the frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). As for A, a positive integer is constituted and, as for n, 3 - the positive integer of A, and m comprise fundamentally the pixel or scanning line of the positive integer individual below n.
Since said pixel or a scanning line is chosen at the predetermined intervals in said subfield, image quality deterioration, such as a cross talk, can be prevented.

[0089]According to this invention, by not synchronizing the cycle of selection of a pixel or a scanning line, or non selection, and the cycle of polarity reversals, the number of the pixel which serves as the same polarity adjacently, or scanning lines can be done small, and the disk disturbance resulting from it can make it be hard to be recognized visually. Since a disk will not flow along with a time-axis, image quality is substantially improvable from vision characteristics.
[0090]According to this invention, the power consumption in a common electrode can be reduced substantially, without degrading image quality by performing writing operation by the usual double speed, and performing polarity reversals for every subfield.
[0091]According to this invention, the leakage current by TFT and a liquid crystal layer is controlled by changing the inversion cycle in a maintenance period, and it is + writing. - Holding property which writes in and comes out can be made equal, and image quality can be improved substantially. In a common electrode, since writing operation can be performed after the common electrode has risen on desired voltage by making it during the maintenance reversed to the polarity at the time of the next writing, the write-in characteristic can be optimized and image quality can be improved substantially.
[0092]According to this invention, by taking a long write period according to a polar inversion cycle, the write-in characteristic to a picture element electrode can be raised, and image quality can be improved substantially.

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PRIOR ART

[Description of the Prior Art]Since the liquid crystal display is lightweight at a thin shape and the low voltage drive is possible for it, it begins a wrist watch and a calculator and is widely used for the word processor, a personal computer, a small game machine machine, etc. These days, the demand of pen input electronic notebooks increases and the demand to a portable terminal (PDA) is expanded in connection with this.
[0003]When making a liquid crystal display drive, in the same screen, there is a drive method which reverses polarity and to this drive method. The signal wire reversal which reverses polarity for every signal wire, the horizontal polarity reversals (it is hereafter called H reversal) which reverse polarity for every scanning line, and the dot inversion which reverses polarity between the adjoining pixels are mentioned. These drive methods can compensate the flicker ingredient (for example, field flicker) by polar reversal. In particular, H reversal is widely used increasingly by demand to the low resisting pressure driver for single-sided arrangement of the signal wire driver accompanying narrow-picture-frame-izing, and also low power consumption.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In a big screen and LCD which becomes highly minute, the number of signal wires increases and the capacity component between a common electrode and a signal wire becomes large. According to the distance from the feeding point, a resistance component changes with the sheet resistance of a common electrode a lot. For this reason, since the damping time constants of a common electrode differ in a screen as shown in drawing 19 when the polarity reversals of a common electrode are performed, variation (a waveform becoming blunt) arises in the pressure value of a common electrode. When it displays on a window, this serves as image quality deterioration well known as a cross talk, in order to be dependent on a signal level. Although it is possible as a method of solving this to usually lower the sheet resistance of a common electrode, there is a limit in this method and it is not enough.
[0005]This invention is made in view of this point, and is a thing.
The purpose is to provide a liquid crystal display which can prevent the image quality deterioration of **, and a drive method for the same.

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MEANS

[Means for Solving the Problem]A substrate of a couple which has a switching element from which this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, A liquid crystal material pinched between substrates of said couple, and a driving means made to drive with the same polarity about a selected scanning line to a pixel group arranged to the same scanning line, A polarity-reversals means to reverse said polarity and to compensate a flicker is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). As for A, a positive integer is constituted, as for n, 3 - a positive integer of A, and m comprise fundamentally a pixel or a scanning line of a positive integer individual below n, and a liquid crystal display choosing said pixel or a scanning line at the predetermined intervals in said subfield is provided.
[0007]A substrate of a couple which has a switching element from which this invention chooses A pixels or a scanning line and said pixel, or a scanning line on at least one substrate, A liquid crystal material pinched between substrates of said couple is provided, a viewing area is divided into n subfields which display a frame image of one sheet in order along with a time-axis, and said subfield is A/nxm (here). It is a drive method of a liquid crystal display for which a positive integer is constituted as for A and, as for n, 3 - a positive integer of A, and m comprise fundamentally a pixel or a scanning line of a positive integer individual below n, It is made to drive with the same polarity to a pixel group arranged to the same scanning line about a selected scanning line, said polarity is reversed, a flicker is compensated, and a drive method of a liquid crystal display choosing said pixel or a scanning line at the predetermined intervals in said subfield is provided.
[0008]
[Embodiment of the Invention]In a liquid crystal display and a drive method to this invention, When a picture is displayed with A pixels or scanning line by which the switch INGU element for selection was allocated in each, It divides into n subfields which display the frame image of one sheet in order along with a time-axis, and is said subfield Said two or more pixels or A/nxm (here) of the scanning lines A constitutes a positive integer and n constitutes the positive integer below A, and m fundamentally with the pixel or scanning line of a positive integer individual below n or more from three.
[0009]In order to improve image quality, it is made for the scanning line group which serves as different polarity as much as possible from the scanning line which writes in, and the scanning line of that neighborhood, and serves as the same polarity adjacently to serve as the minimum in this composition.
[0010]When displaying a picture with a scanning line, interlace processing of the picture signal of the frame image of one sheet is carried out to n:m, and said switching element is made to choose and drive according to this processed picture signal. Since the selection frequency of a scanning line is reduced according to this drive method and the multi-field driving method, low power consumption is realized, and the flicker ingredient (for example, field flicker) by reversal of each polarity can be

compensated with that selection method.
[0011]Have the above-mentioned composition, namely, according to this invention which adopts H reversal and a multi-field drive simultaneously. Since the voltage of a common electrode rises, and it becomes blunt, when the real row voltage to a pixel changes with picture signals, by reversing the polarity of a common electrode before the selection period of a scanning line, Since writing operation is performed after the voltage of a common electrode has risen thoroughly, distribution of voltage in the screen of the common electrode depending on a picture signal can always be made uniform, and the image quality deterioration by a cross talk can be improved substantially. Since it synchronizes with a polar inversion cycle, ON time of a gate line is lengthened and the write time to a picture element electrode can be lengthened, the write-in characteristic to a picture element electrode can be raised.
[0012]When this H reversal and a multi-field drive are used simultaneously, and a polar inversion cycle and the selection cycle of a scanning line synchronize, it may become a situation which adjoins over two or more scanning lines, and is displayed with the same polarity, and a disk may arise in a display. In order to change that position along with a time-axis, this same adjoining polar scanning line group becomes what is not a stationary thing and moves, and when it goes into the field recognized visually with the visual frequency characteristic between space-time, it will be produced as large image quality deterioration.
[0013]In a high definition picture which does not have correlation in a picture, a flicker ingredient is no longer compensated and distortion may arise by return according to the difference of the flicker ingredient. Since it becomes what is not a stationary thing and moves also about this clinch distortion, when it comes into the field recognized visually with the visual frequency characteristic between space-time, it is made for image quality deterioration to be produced substantially.
[0014]In a multi-field drive, since a maintenance period becomes large substantially, the flicker ingredient for every scanning line becomes large. Therefore, the line disturbance produced for every subfield will be recognized visually, and there is a problem which causes the image quality deterioration of a still picture.
[0015]In order to prevent degradation of the image quality by such line disturbance and disk disturbance, and clinch distortion which originates in it further, it is made the field which is not recognized visually by the visual frequency characteristic between space-time by the following means.
[0016]The interval of the pixel chosen in a subfield as the 1st means or a scanning line is made the same between each subfield, and the cycle which reverses polarity for each pixel or a scanning line to selection or the cycle which makes non selection is made inharmonious.
[0017]A polar inversion cycle is made to differ between each subfield in the 1st means as the 2nd means (it is made not the same).
[0018]That is [as the 3rd means it changes and displays the interval of said pixel chosen in a subfield, or a scanning line according to the cycle of polarity reversals], selection or the cycle which makes non selection is made inharmonious for each pixel or a scanning line to the cycle of polarity reversals. The interval of the pixel chosen in a subfield or a scanning line may be made the same between each subfield.
[0019]As the 4th means, the interval of the pixel chosen in a subfield or a scanning line is made inharmonious to a polar inversion cycle, and the interval of the pixel chosen between each subfield or a scanning line is made to differ. In a subfield, a polar inversion cycle may be made the same between each subfield.
[0020]According to the 1st means, with the polar inversion cycle which compensates a flicker, even if it becomes at least the scanning order which is easy to produce image quality deterioration, a polar inversion cycle can be changed selectively and image quality deterioration can be improved substantially.
[0021]According to the 1st and 3rd means, it becomes that it is not applied to the field which the

scanning line group which adjoins spatially and serves as the same polarity does not arise, or is recognized visually by vision characteristics, or is hard to be recognized visually. In the 1st and 3rd means, since a picture is displayed with a scanning line, when interlace processing of the picture signal is carried out to n:m, the number of scanning lines which serves as the same polarity adjacently between the scanning lines which adjoin in one frame can be made below into n. Therefore, the flicker (luminance difference) accompanying write-in polarity does not have periodicity spatially in a panel surface, or the spatial frequency in a panel surface becomes high. For this reason, it becomes that the same polarity group (disk) resulting from the polar inversion cycle and the selection cycle of the switching element of a multi-field drive having synchronized, for example is not applied to the field recognized visually by vision characteristics, or is hard to be recognized visually, and image quality deterioration can be improved substantially.

[0022]When it generates on a spatial frequency axis as a career with a new flicker accompanying write-in polarity and distortion arises by return by it in a high definition picture which does not have correlation in a picture, also about this clinch distortion. Since the spatial frequency in a panel surface becomes high or it does not have periodicity spatially, it becomes that it is not applied to the field recognized visually by vision characteristics, or is hard to be recognized visually, and degradation of image quality can be improved substantially.

[0023]Since the election priority of a scanning line is selectively changeable even if it becomes a polar inversion cycle which is easy to produce image quality deterioration depending on selection or the cycle which makes non selection of a scanning line according to the 3rd means, image quality deterioration is substantially improvable.

[0024]According to the 2nd and 4th means, when a flicker cannot be compensated depending on one certain method, it can carry out that it is hard to be recognized visually by migrating to two or more subfields and changing selection or the cycle which makes non selection of a polar inversion cycle and a scanning line. These one method and 2nd and 4th means can also be used simultaneously. When compensating the flicker produced according to polar reversal, common voltage can also perform, but flicker compensation may be more effectively performed by changing said common voltage according to a polar inversion cycle.

[0025]According to the 2nd and 4th means, a polar inversion cycle is made at least for scanning order to differ for every subfield group, by a certain fixed method, it is not recognized visually by vision characteristics or the flicker and disk flow which may be produced can be carried out that it is hard to be recognized visually.

[0026]In the liquid crystal display of this invention, the kind in particular of the material of a substrate or liquid crystal material is not restricted.

[0027]Hereafter, an example is concretely described for this invention with reference to drawings.

[0028](Example 1) Each following example applies the multi-field driving method which lowers drive frequency by dividing one frame (frame image of one sheet) into two or more subfields. Since the multi-field driving method is indicated in JP,3-271795,A, the detailed explanation is omitted.

[0029]In Example 1, the interval of the pixel chosen in a subfield or a scanning line is made the same between each subfield, and the case where a polar inversion cycle is made inharmonious is explained to the cycle of selection of a pixel or a scanning line, or non selection.

[0030]Drawing 1 is a schematic diagram showing the composition of the important section of the liquid crystal display of this invention. Drawing 2 is a figure showing the input picture signal and inversion signals at the time of using a multi-field drive, n= 3, m= 1 (the number of subfields is 3/1=3), and H reversal. The liquid crystal display of this invention The inversion-signals generating part 10 and the common voltage outputting part 11, It mainly comprises the liquid crystal display panel 12, the gate line driving circuit 13, the n:m interlace processing circuit 14, the n counter circuit 15, the signal wire driver 16, and the scanning line selection signal generation circuit 18. The liquid crystal display panel 12 comprises a liquid crystal material pinched between the substrate of the couple which has a switching element which chooses a pixel or a scanning line and a pixel, or a

scanning line on at least one substrate, and the substrate of a couple.
[0031]In the liquid crystal display of the above-mentioned composition, as shown in drawing 2, in a certain subfield, one scanning line is chosen as three every two by the scanning line selection signal S1, and the scanning line under one of the selected scanning lines is chosen one by one in a similar manner in the next subfield. The portion which attached the diagonal line shows the scanning line selected in each subfield among drawing 2. Here, the polarity at the time of the polarity of the non selection scanning line which does not attach the diagonal line choosing each scanning line at the end is maintained. A slash part shows + polarity and a plain part shows - polarity.
[0032]In the drive method of this invention, in order to change a polar inversion cycle according to the election priority of a scanning line, the scanning line selection signal S1 is inputted into the inversion-signals generating part 10 and the gate line driving circuit 13 from the scanning line selection signal generation circuit 18. At this time, the n counter circuit 15 outputs the start pulse to a gate line driver for every field, and is inputted into the count signal S2 ** gate line driving circuit 13 from the n counter circuit 15. The gate line of the scanning line of a switching element drives with this scanning line selection signal S1 and count signal S2.
[0033]On the other hand, the inversion signal P1 which shows a polar inversion cycle is inputted into the n:m interlace processing circuit 14 and the common voltage outputting part 11 from the inversion-signals generating part 10. The inversion signals P1 had reversed polarity for every scanning line and every field, in order to compensate a flicker. It is processed in the n:m interlace processing circuit 14, that signal is inputted into the signal wire driver 16, and this inputted inversion signal P1 reverses the polarity of the signal wire of the liquid crystal display panel 12 based on that signal. This inputted inversion signal P1 reverses the polarity of the common voltage of the liquid crystal display panel 12 via the common voltage outputting part 11.
[0034]The following effects are acquired by such a drive method.
[0035](1) In H inversion driving, since the inversion operation for every scanning line in high frequency is usually needed, it is necessary to design a driver so that current may flow enough at the moment of being reversed. After making it once shift to high potential at the time of reversal, it is made to drive conventionally using the driver who, on the other hand, enlarged current gain from a direction, for example, the driver which made current easy to flow through into - side from + side. This operating becomes unnecessary or it becomes unnecessary to send current greatly by combining H inversion driving and a multi-field drive at the time of reversal. For this reason, since timing of writing can be made late, the driver in which high-speed operation is possible becomes unnecessary.
[0036](2) In H inversion driving, the polarity of a driver becomes the same [every signal wire]. Therefore, since the signal (adjustment signal) given from D0 serves as the same polarity in that time then, it will enlarge an effect at the polarity (+ or -) of **. For example, - writing usually has bad maintenance to + writing. Therefore, maintenance of - writing can be made good by making an adjustment signal - slippage. In this case, although it is possible that maintenance of + writing worsens, image quality is improvable by making holding property of amphipathy equivalent.
[0037](3) There is a phenomenon "thrust to one of the causes of image quality deterioration", and when gate voltage falls at the time of the switching OFF of TFT (ThinFilm Transistor), as for this, change pixel potentials by coupling by parasitic capacitance.
[0038]Since this amount of change differs in how whose gating signal becomes blunt by screen right and left (it follows for separating (it goes to the wave-like right), and it becomes blunt, although the neighborhood of a gate driver is sharp), it changes with screen right and left. Therefore, in order to improve this, by screen right and left, an inclination can be attached and the size of D0 can be given.
[0039](4) The switching characteristic of TFT is determined by the ON voltage and OFF voltage of gate voltage. Since the polarity of the pixel which adjoins that it is signal wire inversion driving differs, ON voltage and OFF voltage cannot be decided according to each polarity. In the case of H

inversion driving, this becomes possible, but since the inversion driving cycle is usually short, power will be consumed if voltage is shifted at every time.
[0040]Since the inversion driving cycle will be 4 times the H inversion driving by combining H inversion driving and a multi-field drive, according to each polarity, ON voltage and OFF voltage can be decided good, and, thereby, image quality can be improved.
[0041]When performing scanning line selection and reversal as shown in drawing 2, in order to migrate to three subfields and to scan to line sequential, a front scanning line and the following scanning line serve as the same polarity. Therefore, when the 1 field comprises the subfields SF11-SF13 of three sheets, image quality may be degraded as what is called a disk flow that three scanning line groups which the same polarity adjoins move.
[0042]Then, next, the case where it displays by changing the polar inversion signal P1 according to a scanning line selection signal is explained.
[0043]With the signal S1 received from the scanning line selection signal generation circuit 18, from an inversion-signals generating part, they are made by the inversion signals P1 in this example, and in the n:m interlace processing circuit 14, The output control of the picture information used as the picture information chosen according to S1 and non selection is performed, and conversion of picture information is performed by P1. Although there is no restriction in particular in the contents of processing performed by the n:m interlace processing circuit 14, they are the contents of processing for improving degradation of a display image.
[0044]There is no restriction in particular about conversion of picture information, and about the case where a signal level is determined, for example according to reversal of common voltage, also in the same gradation, conversion is performed so that it may be set to the signal level which differs in + writing and - writing. For example, when the liquid crystal cell which shows a voltage-transmittance curve as shown in drawing 3 is used, in + writing, the transmissivity of T1 will be shown to the signal level of V2, and - writing will show the transmissivity of T1 to the signal level of V1.
[0045]In this example, a picture signal is a digital signal and within the signal wire driver 16 Digital to analog. It is performing (it is hereafter called D/A), the picture signal (referred to as DV1 and DV2, respectively) of V1 and V2 serves as a following formula, and an input picture signal and a polar inversion signal are outputted corresponding to 1:1.
[0046]
[Equation 1]
$$DV1 = \overline{DV2}$$

[0047]In this case, polar inverting means are changed and there is the necessity (here, denial is taken) of also changing an input picture signal. For example, exclusive OR is taken between inversion signals (P0) and the inversion signals (P1) which performed processing which improves degradation of a display image, a picture signal is denied in one state, and the output to the signal wire driver 16 is performed. Drawing 4 (A) shows the contents of processing currently performed in the n:m interlace processing circuit 14, and drawing 4 (B) shows the signal wave form of each part. Although the contents of processing in particular in drawing 4 (A) are not restricted, it has the selector 31 and the selector 32, for example, In the selector 31, the picture signal D1 or D0 is chosen with a scanning line selection signal, and a picture signal inverted output is chosen by the exclusive OR of P0 and P1 in the selector 32.
[0048]Here, actually, although D0 is a signal which is not written in, it is a signal required in order to amend by applying a certain voltage to an organization which has not been chosen to a signal wire. In this case, although what kind of thing D0 may be, what improves image quality through coupling (capacity) between a signal wire and a pixel is preferred. Therefore, D0 can also be made into the same signal as D1.
[0049]In the above-mentioned explanation, although a case where reversal of write-in polarity and a

picture signal was in agreement was described, in a voltage-transmissivity characteristic, it may change into a suitable picture signal for every polarity by providing a reference part which can compare each signal-level value and picture signal information.

[0050]In this invention, a disk flow into which a scanning line group which makes the minimum a scanning line group which serves as the same polarity adjacently, or serves as the same polarity flows can make it be hard to be recognized visually by combining two methods, a polarity-reversals method and a selection method of a scanning line.

[0051]Drawing 5 shows a picture displayed on a liquid crystal display panel by signal concerning a drive method of this invention, and its signal. A portion which a slash part showed + polarity among drawing 5, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0052]Here, it is a case where n= 4 and m= 1 (the number of subfields is 4/1=4) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced. A scanning line under one which makes a polar inversion cycle every four scanning lines, and chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum, and so that it may become upper scanning line and reverse polarity. Even when a multi-field drive is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high.

[0053]Here, since it is necessary to compensate between scanning lines when using the multi-field driving method, two or more polar biases become important. For example, in this example, a compensation relation to a problem in every four becomes, and a scanning line group toward which polarity inclines at a rate of 3:1 exists in drawing 5. However, a disk flow becomes one 3 times the flowing velocity of this, and this scanning line group becomes in the following field that it is hard to be recognized visually in order to move by 3 pixels. Although especially this drive method is effective in a 2n:1 (n>=2) multi-field drive, it is not restricted to the above-mentioned example.

[0054]Drawing 6 shows an example of change of an inversion cycle of drawing 5, and shows a picture displayed on a liquid crystal display panel by signal which starts a drive method of this invention like drawing 5, and its signal. Here, the polarity of a scanning line is unified all over a subfield, and it is considered as a cycle reversed for every subfield. A portion which a slash part showed + polarity among drawing 6, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0055]Here in a multi-field drive, n= 5, m= 1. (however, the number of subfields is a case where 5) is used, also in this case, can reduce drive frequency and can reduce power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 similarly. All over a subfield, since common voltage is maintained at fixed voltage (+ polarity or - polarity), in the signal wire driver 16, the liquid crystal display panel 12, and the common voltage generating part 11, a reduction effect of power consumption becomes large more. However, in this method, since + writing and - writing are performed on the whole screen, generating of a field flicker can be considered.

[0056]Then, as shown in drawing 7 (A) and (B), carry out double-speed processing of the inputted image information, and a data constellation of the following subfield is recorded on a memory, and a data constellation of a subfield of another side is written in by SF1. For example, about writing in this case, it carries out with + polarity. Then, said subfield and polarity are reversed and writing of a data constellation recorded on said memory is written in throughout [two SF] with - polarity. Since this subfield period is performed by period of a half of the usual multi-field drive, a field flicker goes

into a high frequency domain, and is not recognized visually. In this case, although power consumption in a clock part of the gate line driving circuit 13 increases, since power consumption in the common voltage generating part 11 is reduced substantially, as the whole, power consumption becomes low.

[0057]A memory may be provided in the n:m interlace processing circuit 14 shown in drawing 1, and the above-mentioned processing may be performed using the memory. Here, in order to explain simply, are not describing a gap in particular of timing of a signal by buffer in the n:m interlace processing circuit 14 and a buffer within a signal wire driver, but. Timing with a scanning line is coincided so that a desired picture may be acquired actually.

[0058]Although an increase in the number of ICs by having a memory and an increase in power consumption are expected, as shown in drawing 8, it can have composition which does not have a memory in a module by controlling a signal output from the computer side which outputs a signal. Usually, in an information terminal body, a signal output to a module is controlled by Video RAM 21 and the control circuit 22. In this example, in order to change an inputted image according to a processing means of a n:m interlace, the scanning line selection signal S1 of a modular circuit is inputted into this control circuit 22 from the scanning line selection signal generation circuit 28. And the control circuit 22 will change specification of an address and output timing of a picture between Video RAMs 21. In drawing 8, the reference numbers 23-27 show a liquid crystal display panel, a n:m interlace processing circuit, a signal wire driver, n counter circuit, and a gate line driving circuit, respectively, and these functions of them are the same as that of a case where it is shown in drawing 1.

[0059]Since an inversion cycle of common voltage can be substantially made low, a standup of common voltage in the time of polarity reversals can be prevented from becoming a problem in this example. That is, in order for what is necessary to be just to reverse the polarity of common voltage during a blanking period, a comparatively long damping time constant of common voltage at the time of writing will be taken. Therefore, sheet resistance of a counterelectrode can enlarge. Or the feeding point can be lessened.

[0060]When carrying out double-speed processing of the 2n+1:1 (n>=1) multi-field drive, although the above-mentioned drive method is effective, it is not restricted in particular to the above-mentioned example.

[0061](Example 2) In Example 2, an interval of a pixel chosen in a subfield or a scanning line is made the same between each subfield, and make a polar inversion cycle inharmonious to a cycle of selection of a pixel or a scanning line, or non selection, and let a polar inversion cycle be different [1] also between the fields.

[0062]Drawing 9 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 9, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.

[0063]Here, in a multi-field drive, it is n= 5 and m= 2 (although the number of subfields is set to 2.5). it is constituted by subfield of three sheets as a display image -- **** -- it is a case where it uses, and drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced. In this case, reversal which makes polar inverting means the same polarity every every three scanning lines and 2 scanning lines is performed by turns, and a scanning line under one which chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum and it may become upper scanning line and reverse polarity. Even when the multi-field driving method is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high.

[0064]However, in this method, since + writing and - writing incline and exist at a rate of 3:2 in a screen, it is expected that a dc component is impressed to a liquid crystal material and an orienting film. Then, a rate of the number of scanning lines of + writing and - writing is switched for every number subfield. In this case, although it is thought that there is a possibility that a field flicker at the time of a change may be recognized visually, image quality deterioration can be reduced by lowering to below change frequency (for example, 1 [Hz]) that is not recognized visually with vision characteristics. It may be made to output common voltage which becomes the optimal according to a polar bias from the common voltage generating part 11.
[0065]Drawing 10 shows an example of change of a selection method of a scanning line of drawing 9, and shows a picture displayed on a liquid crystal display panel by signal which starts a drive method of this invention like drawing 9, and its signal. In a drive method shown in drawing 10, two scanning lines are not continuously driven all over a subfield. A portion which a slash part showed + polarity among drawing 10, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.
[0066]It is [in / here / a multi-field drive] n= 5 and m= 2 (although the number of subfields is set to 2.5). it is constituted by subfield of three sheets as a display image -- **** -- it is a case where it uses, and drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced. Reversal which makes polar inverting means every three scanning lines and the polarity same [two whole scanning lines] also in this case is performed by turns, and a scanning line under one which chooses further in the following field is writing in so that a scanning line group which serves as the same polarity adjacently may serve as the minimum and it may become upper scanning line and reverse polarity.
[0067]Even when the multi-field driving method is adopted by doing in this way, a scanning line which serves as the same polarity adjacently can be made or less into two, and spatial frequency can be further made high. In this method, although + writing and - writing incline and exist at a rate of 3:2 with every scanning line, it is equalized in a screen and it is possible that a dc component is not impressed by an orienting film compared with a case of drawing 9.
[0068]A rate of the number of scanning lines of + writing and - writing may be switched for every number subfield like a case where it is shown in drawing 9 also in this case. Although especially this drive method is effective in a 2n+1:2 (n>=1) multi-field drive, it is not restricted to the above-mentioned example.
[0069](Example 3) In Example 3, an interval of a pixel chosen in a subfield or a scanning line is changed to a polar inversion cycle.
[0070]Drawing 11 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 11, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.
[0071]Here, it is a case where n= 6 and m= 2 (the number of subfields is 3) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced.
[0072]When this drive method is used, a portion from which the number of scanning lines which serves as the same polarity adjacently does not become [this / below / n] arises. However, since an interval of a disk changes and a disk flow is also lost as shown in drawing 11, a space spectrum of a disk becomes that it distributes and is hard to be recognized visually, and is simultaneously effective also to distortion by return.
[0073](Example 4) In Example 4, an interval of a pixel chosen in a subfield or a scanning line is

changed to a polar inversion cycle, and it is considered as different [1] between each subfield.
[0074]Drawing 12 shows a picture displayed on a liquid crystal display panel by signal concerning other drive methods of this invention, and its signal. A portion which a slash part showed + polarity among drawing 12, and a plain part showed - polarity, and attached a diagonal line shows a scanning line selected in each subfield. Here, polarity at the time of the polarity of a non selection scanning line which does not attach a diagonal line choosing each scanning line at the end is maintained.
[0075]Here, it is a case where n= 3 and m= 1 (the number of subfields is 3) are used in a multi-field drive, Drive frequency can be reduced and power consumption in the signal wire driver 16, the gate line driving circuit 13, the liquid crystal display panel 12, and the common voltage generating part 11 can be reduced.
[0076]In this drive method, an election priority of a scanning line is made the same by SF1-SF6, and + polarity and - polarity are reversed between subfields. It is made an election priority which is different from the above by SF7-SF12 continuing, and polarity is reversed between subfields. SF13-SF18 were performed similarly, and an election priority of a scanning line has included a portion which does not become the same. By doing in this way, it can carry out to a disk or a disk flow produced when it drives by a certain fixed election priority that it is hard to be recognized visually.
[0077](Example 5) Example 5 is an application which raises image quality by changing a polarity-reversals method during a maintenance period in each of above-mentioned examples.
[0078]In a multi-field drive, in order that a period which makes non selection of the scanning line may not perform writing operation, even if it changes signal line voltage and common electrode voltage, a picture element electrode is in floating theoretically, and, for this reason, an electric field concerning a liquid crystal layer is kept constant. However, actually, leakage current occurs and picture element electrode potential changes with the switching characteristics of TFT and the characteristics of a liquid crystal material which are switching elements. In this case, pixel-potentials change and a luminance change by leak are improvable by controlling polarity reversals in a maintenance period.
[0079]Here in a multi-field drive, are a case where n= 4 and m= 1 (the number of subfields is 4/1=4) are used, and usually at the time of - writing the holding property of (-), + Since leakage current is large compared with the holding property of (+) at the time of writing, as shown in drawing 13, voltage at the time of - writing is made to be impressed to a signal wire, concerning polarity in a maintenance period. In this figure, in order to make it intelligible, the signal wire Xn and a pressure value impressed to Xn+1 have shown voltage to common potential (Vcom). Although there is no restriction in particular about the pressure value V0 in this case, it is preferred to make it holding property at the time of + writing and - writing become equal.
[0080]In this case, as processing, the scanning line selection signal S1 is inputted into the signal wire driver 16, and it carries out by outputting V0 made within the signal wire driver 16 in a non selection period to a signal wire. V0 may be given based on D0. In order to raise not only this example but a switching characteristic in a maintenance period, various polar inversion cycles in a maintenance period are changeable.
[0081]In order to improve wave-like **** at the time of a standup by resistance of a common electrode being high and a damping time constant becoming long about the polarity of common voltage, As shown in drawing 14, at the time of writing, a waveform of common voltage can be performed in the state where it rose thoroughly, by making it during the maintenance reversed to polarity at the time of the next writing. For example, as shown in drawing 15 (A), when it displays on a window, as shown in drawing 15 (B), a portion from which contrast differs in window right and left arises, and image quality deterioration by a cross talk arises.
[0082]For example, when black is displayed in a window and intermediate color is displayed outside a window, intermediate color of window right and left becomes bright compared with a portion outside of it. This is because it is with a scanning line selection period without a window, and a scanning line selection period with a window and a wave-like standup of common voltage changes with capacity

coupling between a signal wire and a common electrode, as shown in drawing 19. For this reason, at the time of writing, a difference arises in real row voltage to a picture element electrode, and it is thought that a cross talk appears. Since according to this example polarity reversals of common voltage are enough performed early from usual as shown in drawing 16, a wave-like standup of common voltage is not affected. Therefore, a cross talk can be eliminated and image quality can be improved substantially.

[0083]This example is not restricted to a 4:1 multi-field drive, and can be applied to all the n:m multi-field drives. Here, a case where a drive method of this example is applied to Example 2 which performs writing operation of 2LINE continuously is explained.

[0084]When performing writing operation continuously, it is thought that there is no beforehand reversed period about reversal with a common electrode in a write period of the following scanning line (drawing 17 (A)). Also in this case, timing of selection of a scanning line can be carried out by making it shown in drawing 17 (B). In this case, in a gate line driving circuit, it is assumed that it has the function to change timing of a shift register. In drawing 17 (B), after stopping a clock after choosing a scanning line before changing timing and being continuously chosen with a clock, and performing polarity reversals and common voltage fully rises, a clock is re-operated and a signal is shifted. A scanning line after being chosen continuously is chosen by carrying out an ON signal with a scanning line selection signal with this. After that, it is usually alike, and with a more nearly high-speed clock signal, a shift action is performed and it doubles with selection operation of the following scanning line.

[0085]It can be made to be able to synchronize with a polar inversion cycle, and a write period can also be lengthened. For example, as shown in drawing 18 (B), by making a selection period of a scanning line longer than usual, the write-in characteristic can be raised and image quality can be improved substantially. In this case, suppose that processing in the scanning line selection signal generation circuit 18 and the gate line driving circuit 13 is shown, for example in drawing 18 (A).

[0086]Here, it is explaining in the 4:1 multi-field driving method. That is, from a scanning line selection signal, the four scanning line selection signals S10, S11, S12, and S13 are outputted, and each performs an output control of the scanning line G4n, G4n+1, G4n+2, and G4n+3. In this case, a signal from S2 is outputted as a signal which has 4 times as many scanning line selection periods to a signal at the time of only combining a multi-field drive and H reversal. Here, from the signal wire driver 16, a signal which displays a desired picture shall be outputted to a signal wire.

[0087]In the range which is not limited to the above-mentioned example and does not deviate from the gist, it changes variously and this invention can be carried out.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram showing the composition of the important section of the liquid crystal display of this invention.
[Drawing 2]The figure showing a nature cloth with the signal wave form at the time of using the drive method of this invention very much.
[Drawing 3]The figure showing the voltage-transmittance curve of a liquid crystal.
[Drawing 4]As for (A), (B) is a figure for explaining the contents of processing of a n:m interlace processing circuit, and a figure showing the signal wave form of each part.
[Drawing 5]The figure showing the polar distribution at the time of using the signal waveform diagram of a 4:1 multi-field drive, and the drive method of this invention in Example 1.
[Drawing 6]The figure showing the polar distribution at the time of using the signal waveform diagram of a 5:1 multi-field drive, and the drive method of this invention in Example 1.
[Drawing 7](A) It is a block diagram which attaining to and in which showing the contents of processing of a circuit [in / in (B) / the double-speed write-in drive of a 5:1 multi-field drive].
[Drawing 8]The block diagram showing the composition of the conversion process of the picture signal in the liquid crystal display of this invention.
[Drawing 9]The figure showing the polar distribution at the time of using the signal waveform diagram of a 5:2 multi-field drive, and the drive method of this invention in Example 2.
[Drawing 10]The figure showing the polar distribution at the time of using the signal waveform diagram as an example of change of Example 2, and the drive method of this invention.
[Drawing 11]The figure showing the polar distribution at the time of using the signal waveform diagram of Example 3, and the drive method of this invention.
[Drawing 12]The figure showing the polar distribution at the time of using the signal waveform diagram of Example 4, and the drive method of this invention.
[Drawing 13]The figure showing the signal wave form of Example 5.
[Drawing 14]The signal waveform diagram for compensating a leakage characteristic as an example of change of Example 5.
[Drawing 15](A) It is a display image figure which reaching and in which showing the cross talk according [(B)] to a window display.
[Drawing 16]The signal waveform diagram of each part in the time of the window display at the time of performing the drive method of this invention.
[Drawing 17](A) It is a signal waveform diagram showing the selection method and the polar inverting means of the scanning line which reaches and requires (B) for the example of change of Example 5.
[Drawing 18]As for (A), the figure showing the processing constitution concerning the example of change of Example 5 and (B) are the signal waveform diagrams showing the scanning line and the polar inversion cycle concerning the example of change of Example 5.
[Drawing 19]The signal waveform diagram of each part in the time of the window display at the time

of performing the conventional drive method.

[Description of Notations]

10 -- An inversion-signals generating part, 11 -- A common voltage outputting part, 12, 23 -- Liquid crystal display panel, 13, 27 [-- A signal wire driver, 18 28 / -- A scanning line selection signal generation circuit, 21 / -- A Video RAM, 22 / -- A control circuit, 31, 32 / -- Selector.] -- A gate line driving circuit, 14, 24 -- A n:m interlace processing circuit, 15, 26 -- n counter circuit, 16, 25

[Translation done.]

* NOTICES *

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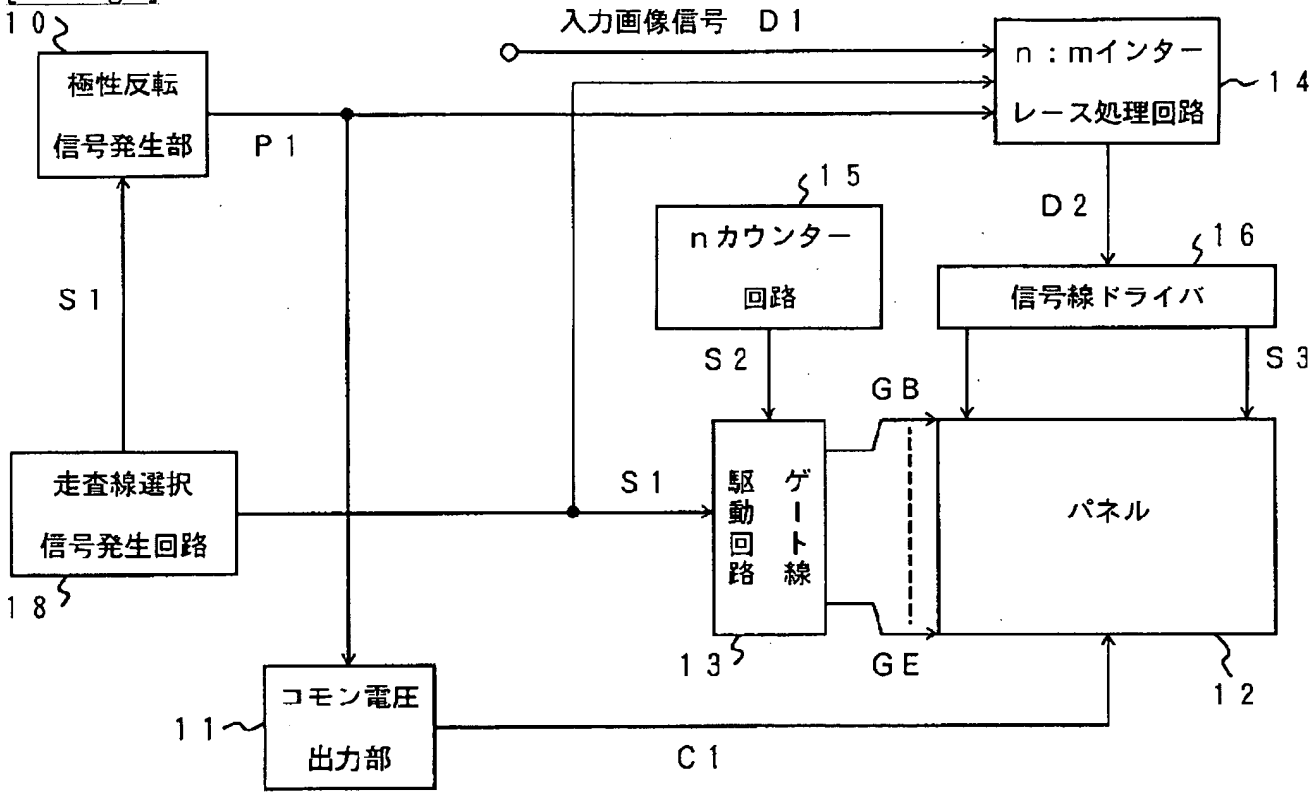
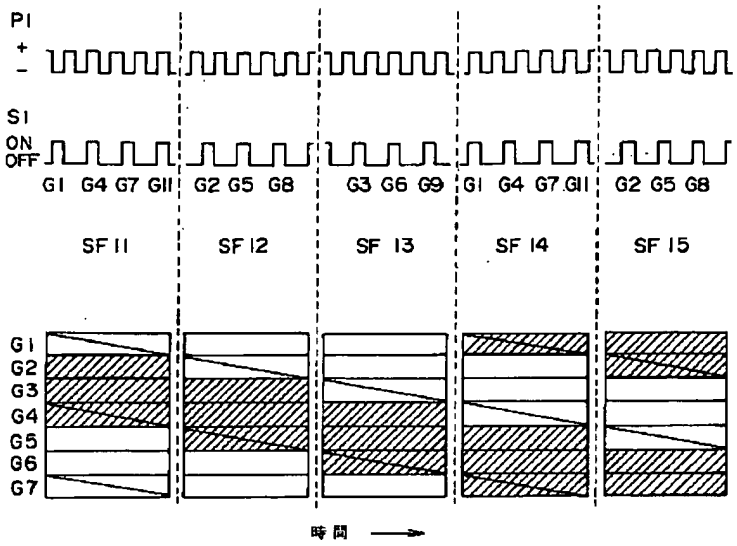
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

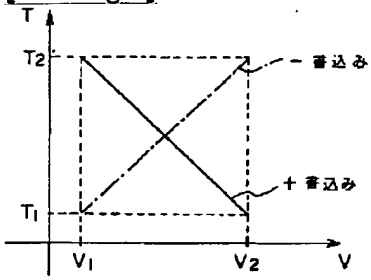
[Drawing 1]



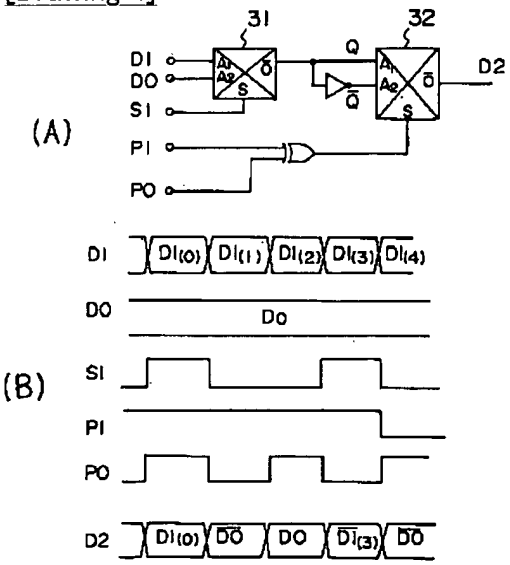
[Drawing 2]



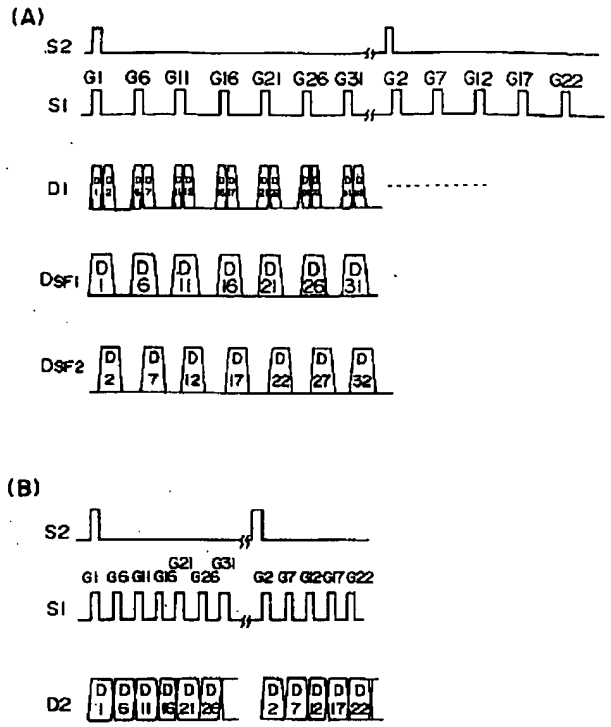
[Drawing 3]



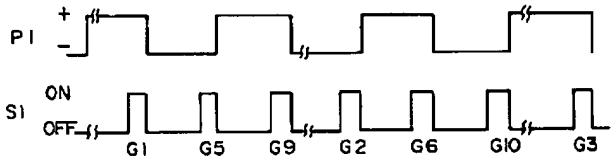
[Drawing 4]



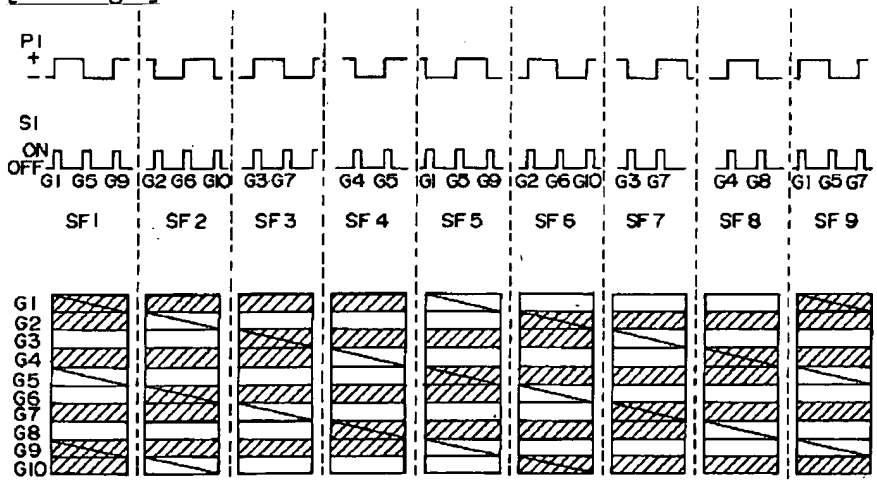
[Drawing 7]



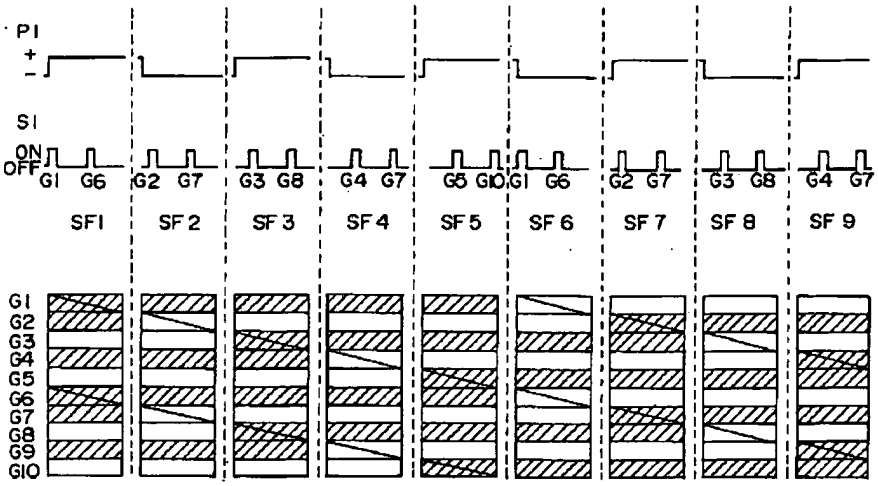
[Drawing 14]



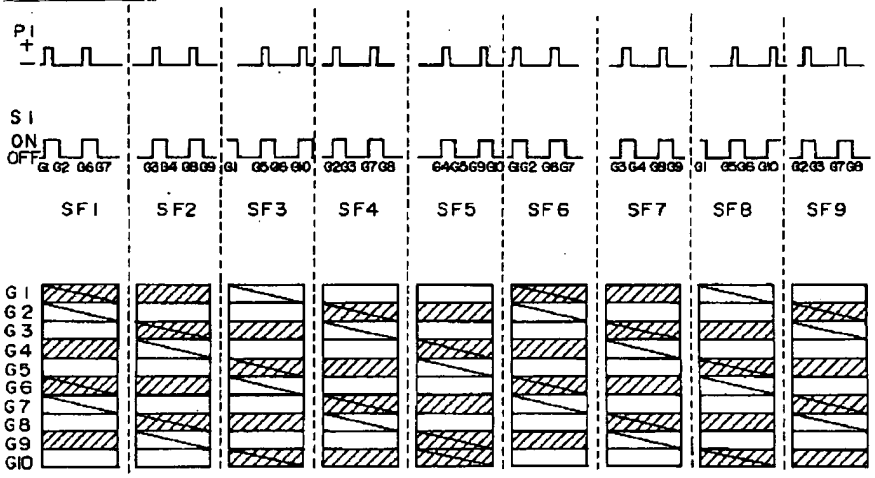
[Drawing 5]



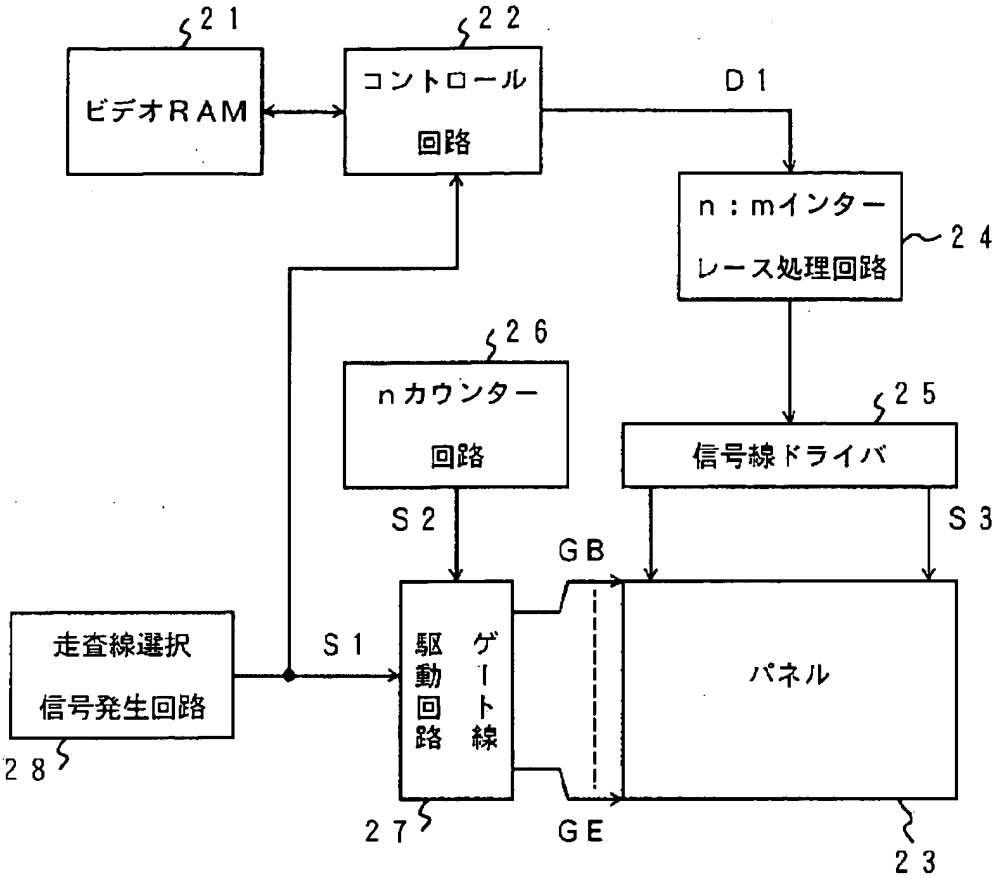
[Drawing 6]



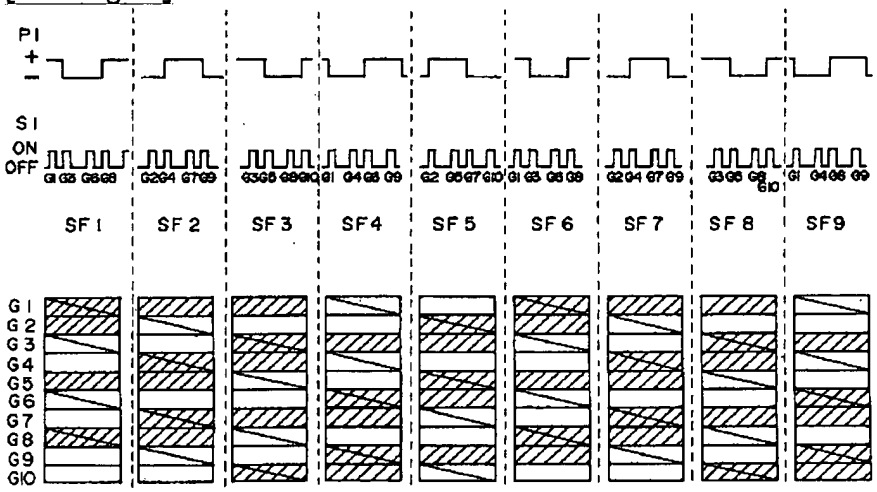
[Drawing 9]



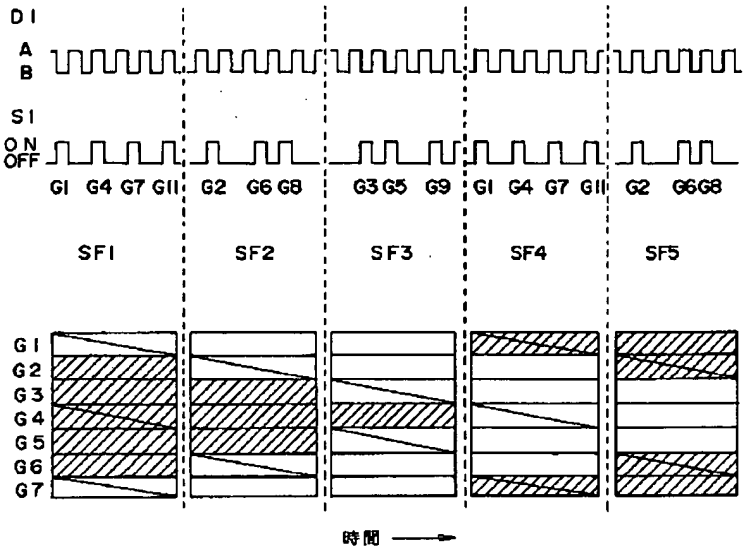
[Drawing 8]



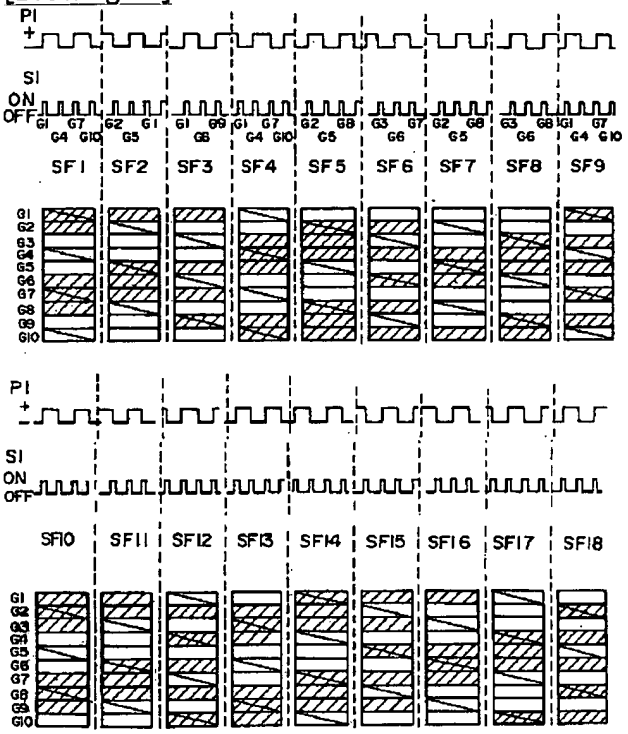
[Drawing 10]



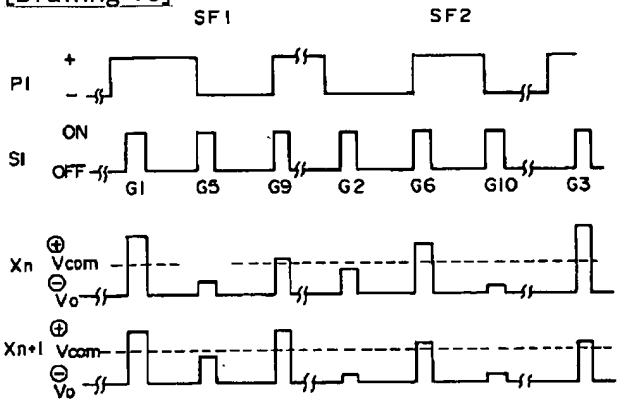
[Drawing 11]



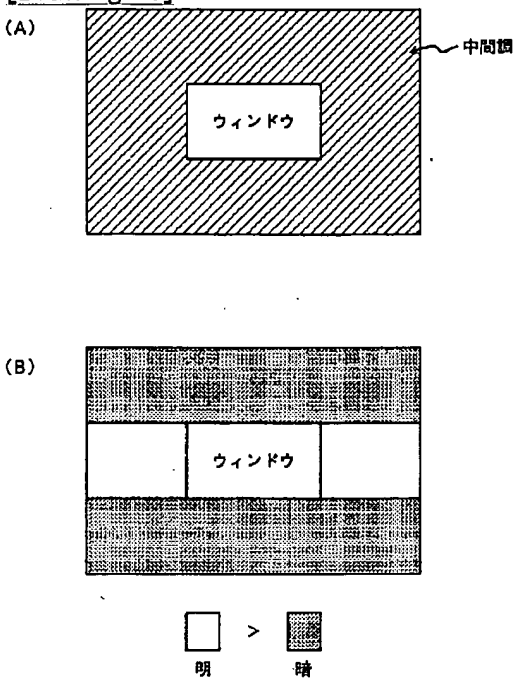
[Drawing 12]



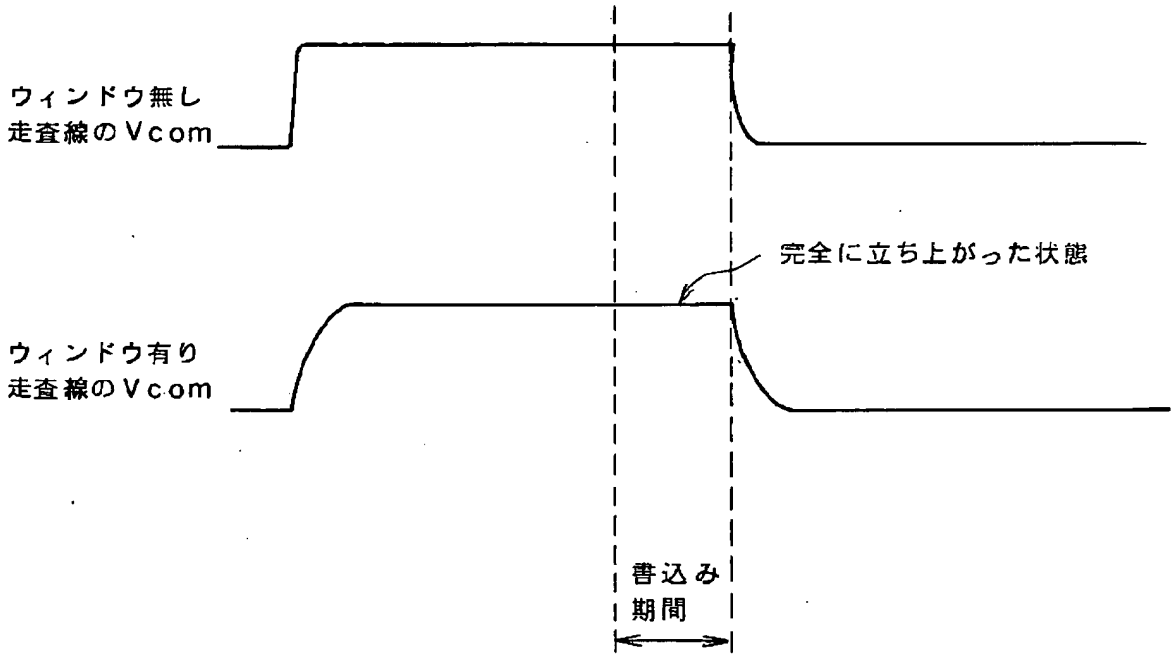
[Drawing 13]



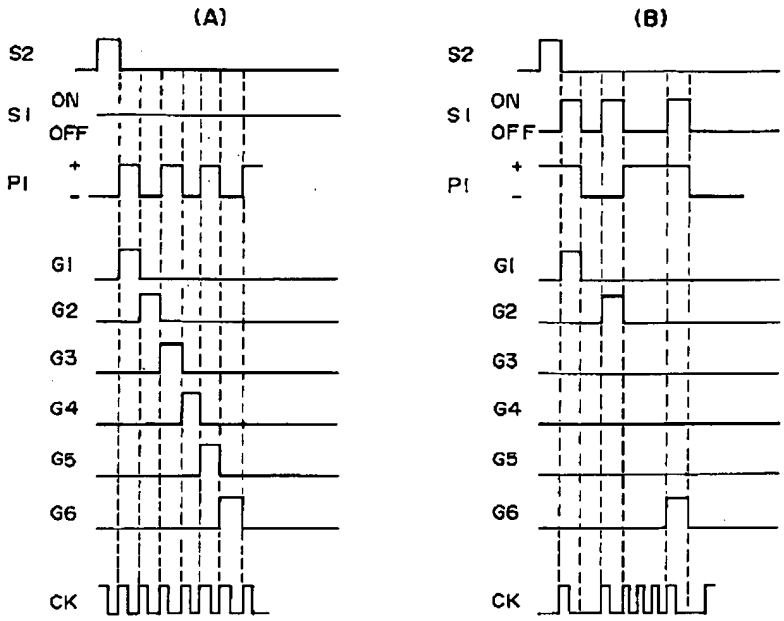
[Drawing 15]



[Drawing 16]

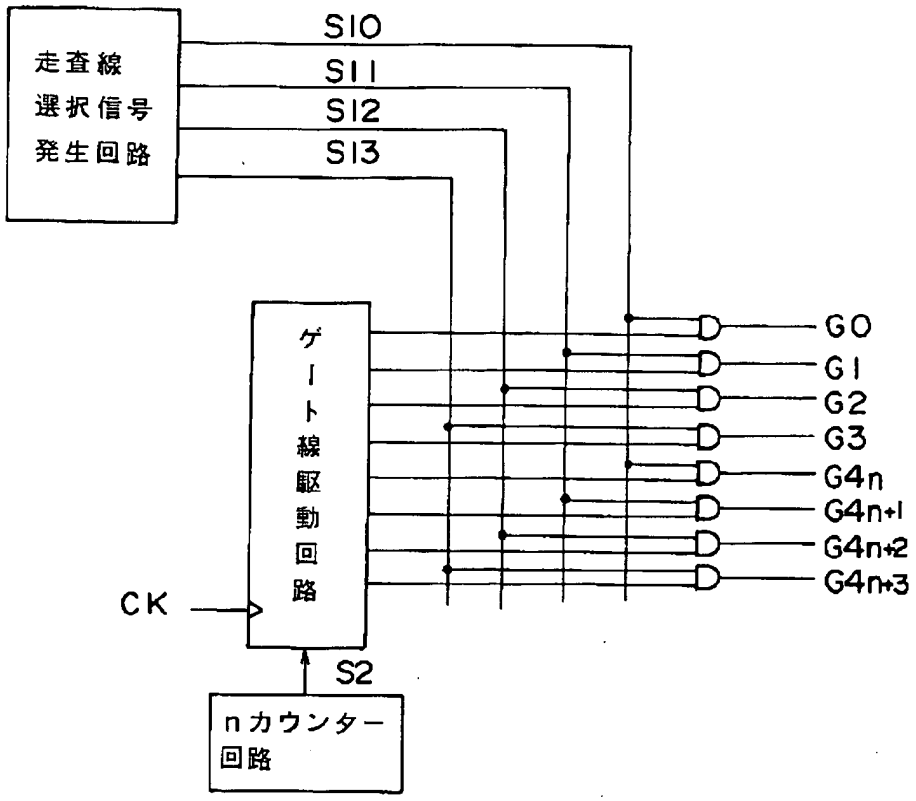


[Drawing 17]

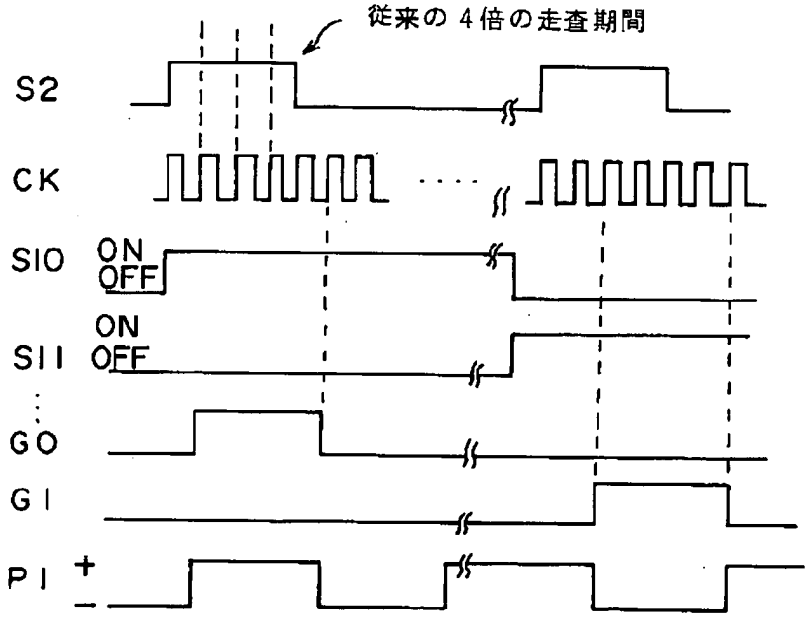

(A)
S2
S1
ON
OFF
P1
+
-
G1
G2
G3
G4
G5
G6
CK
(B)
S2
S1
ON
OFF
P1
+
-
G1
G2
G3
G4
G5
G6
CK

[Drawing 18]

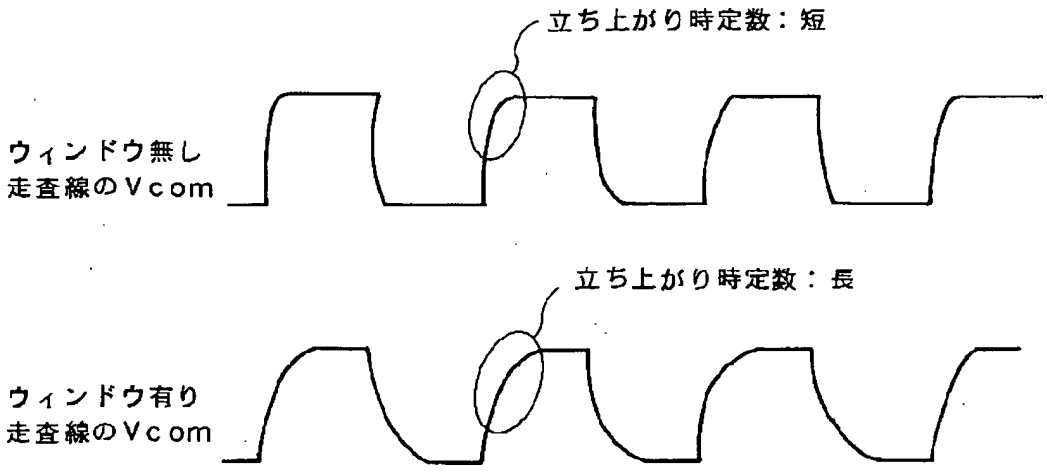
(A)



(B)



[Drawing 19]



[Translation done.]

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	1/136				1/136		
Ｇ０９Ｇ	3/36			Ｇ０９Ｇ	3/36		

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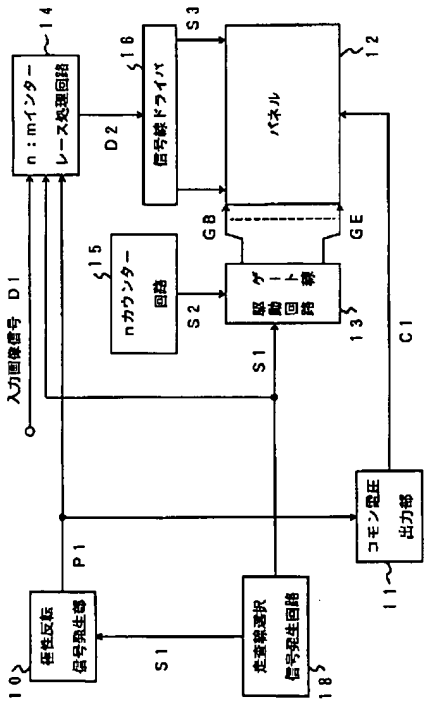
(54)【発明の名称】　液晶表示装置およびその駆動方法

(57)【要約】

【課題】本発明は、クロストーク等の画質劣化を防止できる液晶表示装置およびその駆動方法を提供することを目的とする。

【解決手段】表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されている液晶表示装置の駆動方法であって、選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させ、前記極性を反転させてフリッカを補償し、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択することを特徴としている。



【特許請求の範囲】
【請求項１】少なくとも一方の基板上に、Ａ個の画素もしくは走査線、および前記画素または走査線を選択するスイッチング素子を有する一対の基板と、
前記一対の基板間に挟持された液晶材料と、
選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させる駆動手段と、
前記極性を反転させてフリッカを補償する極性反転手段と、を具備し、
表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されており、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択することを特徴とする液晶表示装置。
【請求項２】　前記サブフィールドにおいて選択する前記画素または走査線の間隔を各サブフィールド間で同一にすると共に、各画素または走査線を選択または非選択する周期に対して、前記極性を反転させる周期を不一致とする請求項１記載の液晶表示装置。
【請求項３】　各サブフィールド間において極性の反転周期を異なるようにする請求項２記載の液晶表示装置。
【請求項４】　前記極性反転の周期に応じて、前記サブフィールドにおいて選択する前記画素または走査線の間隔を変えて表示する請求項１記載の液晶表示装置。
【請求項５】　前記極性反転の周期に対して、前記サブフィールドにおいて選択する前記画素または走査線の間隔を不一致とすると共に、各サブフィールド間において選択する前記画素または走査線の間隔を異なるようにする請求項１記載の液晶表示装置。
【請求項６】少なくとも一方の基板上に、Ａ個の画素もしくは走査線、および前記画素または走査線を選択するスイッチング素子を有する一対の基板と、
前記一対の基板間に挟持された液晶材料と、
を具備し、表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されている液晶表示装置の駆動方法であって、
選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させ、前記極性を反転させてフリッカを補償し、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択することを特徴とする液晶表示装置の駆動方法。
【請求項７】　前記サブフィールドにおいて選択する前記画素または走査線の間隔を各サブフィールド間で同一にすると共に、各画素または走査線を選択または非選択する周期に対して、前記極性を反転させる周期を不一致とする請求項６記載の液晶表示装置の駆動方法。
【請求項８】　各サブフィールド間において極性の反転周期を異なるようにする請求項７記載の液晶表示装置の駆動方法。
【請求項９】　前記極性反転の周期に応じて、前記サブフィールドにおいて選択する前記画素または走査線の間隔を変えて表示する請求項６記載の液晶表示装置の駆動方法。
【請求項１０】　前記極性反転の周期に対して、前記サブフィールドにおいて選択する前記画素または走査線の間隔を不一致とすると共に、各サブフィールド間において選択する前記画素もしくは走査線の間隔を異なるようにする請求項６記載の液晶表示装置の駆動方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、１画素毎もしくは走査線毎に選択用のスイッチング素子が配設された液晶表示装置およびその駆動方法に関する。
【０００２】
【従来の技術】液晶表示装置は、薄型で軽量であり、低電圧駆動が可能であるため、腕時計、電卓をはじめ、ワードプロセッサやパーソナルコンピュータ、小型ゲーム機器等に広く用いられている。最近では、ペン入力電子手帳の需要が高まり、これに伴い携帯用端末機（ＰＤＡ）への需要が拡大している。
【０００３】液晶表示装置を駆動させる場合、同一画面内で極性を反転させる駆動方法があり、この駆動方法には、信号線毎に極性を反転させる信号線反転、走査線毎に極性を反転させる水平方向極性反転（以下、Ｈ反転と呼ぶ）、および隣接する画素間で極性を反転させるドット反転が挙げられる。これらの駆動方法は、極性の反転によるフリッカ成分（例えば、面フリッカ）を補償することができる。特に、狭額縁化に伴う信号線ドライバの片側配置、さらに低消費電力化のための低耐圧ドライバへの要求によって、Ｈ反転が広く使われるようになってきている。
【０００４】
【発明が解決しようとする課題】大画面、高精細となるＬＣＤにおいては、信号線の数が増加してコモン電極と信号線との間の容量成分が大きくなる。また、コモン電極のシート抵抗により、給電点からの距離に応じて抵抗成分が大きく変化する。このため、コモン電極の極性反転を行った場合、図１９に示すように、画面内においてコモン電極の時定数が異なるため、コモン電極の電圧値にバラツキ（波形の鈍り）が生じる。これは、信号電圧に依存するため、ウインドウ表示を行った場合には、クロストークとして良く知られた画質劣化となる。これを解決する方法として、通常コモン電極のシート抵抗を下げることが考えられるが、この方法には限界があり充分なものではない。

【０００５】本発明はかかる点に鑑みてなされたものであり、クロストーク等の画質劣化を防止できる液晶表示装置およびその駆動方法を提供することを目的とする。

【０００６】

【課題を解決するための手段】本発明は、少なくとも一方の基板上に、Ａ個の画素もしくは走査線、および前記画素または走査線を選択するスイッチング素子を有する一対の基板と、前記一対の基板間に挟持された液晶材料と、選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させる駆動手段と、前記極性を反転させてフリッカを補償する極性反転手段とを具備し、表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されており、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択することを特徴とする液晶表示装置を提供する。

【０００７】また、本発明は、少なくとも一方の基板上に、Ａ個の画素もしくは走査線、および前記画素または走査線を選択するスイッチング素子を有する一対の基板と、前記一対の基板間に挟持された液晶材料とを具備し、表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されている液晶表示装置の駆動方法であって、選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させ、前記極性を反転させてフリッカを補償し、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択することを特徴とする液晶表示装置の駆動方法を提供する。

【０００８】

【発明の実施の形態】本発明に液晶表示装置および駆動方法においては、それぞれに選択用のスイッチイング素子が配設されたＡ個の画素もしくは走査線により画像を表示する場合、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割し、前記サブフィールドを前記複数の画素もしくは走査線の内のＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３以上でＡ以下の正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成している。

【０００９】この構成において、画質を改善するために、書込みを行う走査線と、その近傍の走査線とはできるだけ異なる極性となり、隣接して同じ極性となる走査線群が最少となるようにする。

【００１０】また、走査線により画像を表示する場合に、１枚のフレーム画像の画像信号をｎ：ｍにインターレース処理し、この処理された画像信号にしたがって前記スイッチング素子を選択し駆動させる。この駆動方法、マルチフィールド駆動法によれば、走査線の選択回数を減らすので、低消費電力化を実現すると共に、その選択方法によって、各極性の反転によるフリッカ成分（例えば、面フリッカ）を補償することができる。

【００１１】上記構成を有する、すなわちＨ反転とマルチフィールド駆動を同時に採用する本発明によれば、コモン電極の電圧の立ち上がり鈍りのために画素への実行電圧が画像信号により異なる場合に、走査線の選択期間より前にコモン電極の極性を反転させることにより、コモン電極の電圧が完全に立ち上がった状態で書込み動作が行われるため、画像信号に依存するコモン電極の画面内での電圧分布を常に一様にすることができ、クロストークによる画質劣化を大幅に改善することができる。また、極性の反転周期に同期し、ゲート線のＯＮ時間を長くし、画素電極への書込み時間を長くできるので、画素電極への書込み特性を向上させることができる。

【００１２】このＨ反転とマルチフィールド駆動を同時に使用した場合に、極性の反転周期と走査線の選択周期とが同期することによって、複数の走査線にわたって隣接して同じ極性で表示される状況となり、表示において横縞が生じることがある。この隣接した同じ極性の走査線群は、時間軸に沿ってその位置を変えるため、静止したものではなく動くものとなり、視覚の時空間周波数特性で視認される領域に入った場合には、大幅な画質劣化として生じてしまう。

【００１３】さらに、画像に相関が無いような高精細な画像においては、フリッカ成分が補償されなくなり、そのフリッカ成分の差によって折り返し歪が生じることがある。この折り返し歪についても、静止したものではなく動くものとなるため、視覚の時空間周波数特性で視認される領域に入ってくると、大幅に画質劣化を生じさせることになる。

【００１４】また、マルチフィールド駆動においては、保持期間が大幅に大きくなるため、１走査線毎のフリッカ成分が大きくなる。そのため、サブフィールド毎に生じるライン妨害が視認されてしまい、静止画の画質劣化を引き起こす問題がある。

【００１５】このようなライン妨害と横縞妨害、さらにそれに起因する折り返し歪による画質の劣化を防止するために、以下のような手段により、視覚の時空間周波数特性に視認されない領域にする。

【００１６】第１の手段としては、サブフィールドにおいて選択する画素または走査線の間隔を各サブフィールド間で同一にすると共に、各画素または走査線を選択または非選択する周期に対して、極性を反転させる周期を不一致とする。

【００１７】第２の手段としては、第１の手段において、各サブフィールド間において極性の反転周期を異な

るようにする（同じでないようにする）。

【００１８】第３の手段としては、極性反転の周期に応じて、サブフィールドにおいて選択する前記画素または走査線の間隔を変えて表示する、すなわち極性反転の周期に対して、各画素もしくは走査線を選択または非選択する周期を不一致とする。なお、サブフィールドにおいて選択する画素または走査線の間隔を各サブフィールド間で同一にしてもよい。

【００１９】第４の手段としては、極性の反転周期に対して、サブフィールドにおいて選択する画素または走査線の間隔を不一致とすると共に、各サブフィールド間において選択する画素または走査線の間隔を異なるようにする。なお、サブフィールドにおいて極性の反転周期を各サブフィールド間で同一にしてもよい。

【００２０】第１の手段によれば、フリッカを補償する極性の反転周期により、画質劣化を生じ易い走査順位になったとしても、選択的に極性の反転周期を変えることができ、画質劣化を大幅に改善できる。

【００２１】第１および第３の手段によれば、空間的に隣接して同一極性となる走査線群が生じない、または視覚特性により視認される領域に当てはまらない、または視認され難くなる。第１および第３の手段において、例えば、走査線で画像を表示するため、画像信号をｎ：ｍにインターレース処理した場合、１フレーム中に隣接する走査線間において、隣接して同一極性となる走査線数をｎ以下にすることができる。したがって、書込み極性に伴うフリッカ（輝度差）が、パネル面内で空間的に周期性を持たない、またはパネル面内での空間周波数が高くなる。このため、例えば極性の反転周期とマルチフィールド駆動のスイッチング素子の選択周期が同期したことに起因する同一極性群（横縞）が、視覚特性により視認される領域に当てはまらない、または視認され難くなり、画質劣化を大幅に改善することができる。

【００２２】さらに、画像に相関が無いような高精細の画像において、書込み極性に伴うフリッカが新たなキャリアとして空間周波数軸上に発生し、それによって折り返し歪が生じる場合、この折り返し歪についても、空間的に周期性を持たない、もしくはパネル面内での空間周波数が高くなるため、視覚特性により視認される領域に当てはまらない、または視認され難くなり、画質の劣化を大幅に改善することができる。

【００２３】第３の手段によれば、走査線の選択または非選択する周期によっては、画質劣化を生じ易い極性の反転周期になったとしても、選択的に走査線の選択順位を変えられるので、画質劣化を大幅に改善することができる。

【００２４】第２および第４の手段によれば、ある一つの方法によっては、フリッカを補償できない場合に、複数のサブフィールドにわたって、極性の反転周期、および走査線の選択または非選択する周期を変えることにより、視認され難くすることができる。また、この一つの方法と第２および第４の手段を同時に用いることもできる。また、極性の反転に応じて生じるフリッカを補償する場合、コモン電圧によって行うこともできるが、前記コモン電圧を極性の反転周期に応じて変化させることにより、より効果的にフリッカ補償を行ってもよい。

【００２５】第２および第４の手段によれば、走査順位もしくは極性の反転周期をサブフィールド群毎に異なるようにし、ある一定の方法では生じる可能性のあるフリッカならびに横縞流れを視覚特性により視認されない、または視認され難くすることができる。

【００２６】本発明の液晶表示装置においては、基板の材料や液晶材料の種類は特に制限されない。

【００２７】以下、本発明を実施例を図面を参照して具体的に説明する。

【００２８】（実施例１）以下の各実施例は、１フレーム（１枚のフレーム画像）を複数のサブフィールドに分割することにより、駆動周波数を下げるマルチフィールド駆動法を適用したものである。マルチフィールド駆動法は、特開平３－２７１７９５号公報において開示されているので、その詳細な説明は省略する。

【００２９】実施例１においては、サブフィールドにおいて選択する画素もしくは走査線の間隔を、各サブフィールド間で同一にし、画素もしくは走査線の選択または非選択の周期に対し、極性の反転周期を不一致とする場合について説明する。

【００３０】図１は本発明の液晶表示装置の要部の構成を示す概略図である。また、図２はマルチフィールド駆動、ｎ＝３、ｍ＝１（サブフィールド数は３÷１＝３）およびＨ反転を用いた場合の入力画像信号と極性反転信号とを示す図である。本発明の液晶表示装置は、極性反転信号発生部１０と、コモン電圧出力部１１と、液晶表示パネル１２と、ゲート線駆動回路１３と、ｎ：ｍインターレース処理回路１４と、ｎカウンター回路１５と、信号線ドライバ１６と、走査線選択信号発生回路１８とから主に構成されている。なお、液晶表示パネル１２は、少なくとも一方の基板上に、画素もしくは走査線、および画素または走査線を選択するスイッチング素子を有する一対の基板と、一対の基板間に挟持された液晶材料とから構成されている。

【００３１】上記構成の液晶表示装置においては、図２に示すように、あるサブフィールドにおいて、走査線選択信号Ｓ１により３本に１本の走査線が２本置きに選択され、次のサブフィールドでは、選択した走査線の１つ下の走査線が同様にして順次選択される。なお、図２中、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。また、斜線部は＋極性を示し、無地部は－極性を示す。

【００３２】本発明の駆動方法においては、走査線の選択順位に応じて極性の反転周期を変えるため、走査線選択信号発生回路１８から走査線選択信号Ｓ１が極性反転信号発生部１０およびゲート線駆動回路１３に入力される。なお、このとき、ｎカウンター回路１５は、フィールド毎にゲート線ドライバへのスタートパルスを出力するものであり、ｎカウンター回路１５からのカウント信号Ｓ２たゲート線駆動回路１３に入力される。この走査線選択信号Ｓ１およびカウント信号Ｓ２によりスイッチング素子の走査線のゲート線が駆動される。

【００３３】一方、極性反転信号発生部１０から、極性の反転周期を示す反転信号Ｐ１が、ｎ：ｍインターレース処理回路１４およびコモン電圧出力部１１に入力される。極性反転信号Ｐ１は、フリッカを補償するために、走査線毎、フィールド毎に極性を反転させたものとなっている。この入力された反転信号Ｐ１は、ｎ：ｍインターレース処理回路１４において処理され、その信号が信号線ドライバ１６に入力され、その信号に基づいて液晶表示パネル１２の信号線の極性を反転させる。また、この入力された反転信号Ｐ１は、コモン電圧出力部１１を介して液晶表示パネル１２のコモン電圧の極性を反転させる。

【００３４】このような駆動方法により、以下のような効果が得られる。

【００３５】（１）Ｈ反転駆動においては、通常高周波での走査線毎の反転動作が必要となるため、反転した瞬間に充分電流が流れるようにドライバを設計する必要がある。従来、一方方向からの電流利得を大きくしたドライバ、例えば＋側から－側に電流を流れ易くしたドライバを用いて、反転時に一旦高電位にシフトさせてから駆動させている。Ｈ反転駆動とマルチフィールド駆動を組み合わせることにより、この動作が不要となるか、あるいは、電流を反転時に大きく流す必要がなくなる。このため、書き込みのタイミングを遅くできるので、高速動作可能なドライバが不要となる。

【００３６】（２）Ｈ反転駆動においては、ドライバの極性はどの信号線も同一となる。したがって、Ｄ０から与えられる信号（補正信号）は、そのときそのときで同一極性となっているため、どとらかの極性（＋または－）に効果を大きくすることになる。例えば、－書き込みは、＋書き込みに対して通常保持が悪い。したがって、補正信号を－寄りにすることにより、－書き込みの保持を良好にすることができる。この場合、＋書き込みの保持が悪くなることが考えられるが、両極性の保持特性を同等にすることで画質を改善することができる。

【００３７】（３）画質劣化の原因の一つに突き抜けという現象があり、これはＴＦＴ（ThinFilm Transistor）のスイッチングＯＦＦ時にゲート電圧が下がることにより、寄生容量によるカップリングで画素電位が変動するものである。

【００３８】この変動量は、画面左右によってゲート信号の鈍り方が違うため（ゲートドライバの近くはシャープだが、離れる（波形の右に行く）にしたがって鈍る）、画面左右により異なる。したがって、これを改善するために、Ｄ０の大きさを画面左右で傾斜を付けて与えることができる。

【００３９】（４）ＴＦＴのスイッチング特性は、ゲート電圧のＯＮ電圧とＯＦＦ電圧によって決定される。信号線反転駆動であると、隣接する画素の極性が異なるため、それぞれの極性に合わせてＯＮ電圧とＯＦＦ電圧を決めることができない。Ｈ反転駆動の場合にはこれが可能となるが、通常反転駆動周期が短いために、その度に電圧をシフトさせるとパワーを消費してしまう。

【００４０】Ｈ反転駆動とマルチフィールド駆動を組み合わせることにより、その反転駆動周期がＨ反転駆動の４倍となるので、それぞれの極性に合わせてＯＮ電圧とＯＦＦ電圧を良好に決めることができ、これにより画質を改善することができる。

【００４１】図２に示すような走査線選択および反転を行う場合においては、３つのサブフィールドにわたり、線順次に走査を行うため、前走査線と次走査線は、同一の極性となる。したがって、１フィールドが３枚のサブフィールドＳＦ１１～ＳＦ１３で構成される場合、同一の極性が隣接する３本の走査線群が移動する、いわゆる横縞流れとして画質を劣化させることがある。

【００４２】そこで、次に、走査線選択信号に応じて極性の反転信号Ｐ１を変えて表示を行う場合について説明する。

【００４３】本実施例においては、走査線選択信号発生回路１８より受けた信号Ｓ１によって、極性反転信号発生部より極性反転信号Ｐ１が作られ、ｎ：ｍインターレース処理回路１４内では、Ｓ１にしたがって選択される画像情報と非選択となる画像情報の出力制御が行われると共に、Ｐ１により画像情報の変換が行われる。なお、ｎ：ｍインターレース処理回路１４によって行われる処理内容には特に制限はないが、表示画像の劣化を改善するための処理内容になっている。

【００４４】また、画像情報の変換についても特に制限はないが、例えばコモン電圧の反転に合わせて信号電圧を決定する場合については、同一の階調においても、＋書込みと－書込みとで異なる信号レベルとなるように変換が行われる。例えば、図３に示すような電圧－透過率曲線を示す液晶セルを用いた場合には、＋書込みではＶ２の信号電圧に対しＴ.1の透過率を示し、－書込みではＶ１の倡号電圧に対しＴ１の透過率を示すこととなる。

【００４５】本実施例においては、画像信号がデジタル倡号であり、信号線ドライバ１６内でデジタルーアナログ変換（以下、Ｄ／Ａと呼ぶ）を行っており、Ｖ１とＶ２の画像倡号（それぞれＤＶ１とＤＶ２とする）が次式となり、入力画像倡号と極性の反転倡号とは１：１に対

応して出力される。

【0046】

【数1】

$$DV1=\overline{DV2}$$

【0047】この場合、極性の反転方法を変えると共に、入力画像信号をも変換する（ここでは、否定をとる）必要がある。例えば、極性反転信号（P0）と、表示画像の劣化を改善する処理を施した極性反転信号（P1）との間で排他的論理和をとり、1状態においては画像信号を否定し、信号線ドライバ16への出力を行う。図4（A）はn：mインターレース処理回路14で行われている処理内容を示し、図4（B）は各部の信号波形を示す。図4（A）における処理内容は特に制限されないが、例えば、セレクター31およびセレクター32を有し、セレクター31では走査線選択信号によって画像信号D1もしくはD0を選択し、セレクター32ではP0およびP1の排他的論理和によって画像信号反転出力を選択する。

【0048】ここで、D0は、実際には書き込まれない信号であるが、選択していない機関に信号線へ何らかの電圧を加えて補正を行うために必要な信号である。この場合、D0はどのようなものであっても良いが、信号線と画素との間のカップリング（容量）を通して画質を改善するものが好ましい。したがって、D0はD1と同じ信号とすることもできる。

【0049】上記説明においては、書込み極性と画像信号の反転が一致する場合について述べたが、電圧－透過率特性において、個々の信号電圧値と画像信号情報とが比較できる参照部を設けることによって極性毎に適切な画像信号に変換してもよい。

【0050】本発明においては、極性反転方法および走査線の選択方法の2つの方法を組み合わせることによって、隣接して同じ極性となる走査線群を最少とする、もしくは同じ極性となる走査線群が流れる横縞流れを視認され難くすることができる。

【0051】図5は、本発明の駆動方法に係る信号と、その信号により液晶表示パネルに表示される画像を示す。図5中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【0052】ここでは、マルチフィールド駆動において、n＝4、m＝1（サブフィールド数は4÷1＝4）を用いた場合であり、駆動周波数を低減させることができ、信号線ドライバ16、ゲート線駆動回路13、液晶表示パネル12、およびコモン電圧発生部11における消費電力を低減することができる。また、極性の反転周期を4走査線毎とし、さらに次フィールドで選択を行う1つ下の走査線は、隣接して同じ極性となる走査線群が最少となるように、また上の走査線と逆極性となるように書込みを行っている。このようにすることにより、マルチフィールド駆動を採用した場合でも、隣接して同じ極性となる走査線を2本以下にすることができ、さらに空間周波数を高くすることができる。

【0053】ここで、マルチフィールド駆動法を用いる場合、走査線間において補償を行う必要があるため、複数本での極性の偏りが重要となる。例えば、本実施例においては、4本毎の補償関係が問題となり、図5においては、3：1の割合で極性が偏る走査線群が存在している。しかしながら、この走査線群は、次フィールドでは3画素分移動するため、横縞流れが3倍の流れ速度となり、視認され難くなる。この駆動方法は、2n：1（n≧2）マルチフィールド駆動において特に有効であるが、上記実施例に制限されるものではない。

【0054】図6は図5の極性反転周期の変更例を示しており、図5と同様に本発明の駆動方法に係る信号およびその信号により液晶表示パネルに表示される画像を示す。ここでは、サブフィールド中においては走査線の極性を統一し、サブフィールド毎にのみ反転する周期とする。なお、図6中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【0055】ここでは、マルチフィールド駆動において、n＝5、m＝1（ただし、サブフィールド数は5）を用いた場合であり、この場合も同様に、駆動周波数を低減させることができ、信号線ドライバ16、ゲート線駆動回路13、液晶表示パネル12、およびコモン電圧発生部11における消費電力を低減することができる。さらに、サブフィールド中では、コモン電圧が一定の電圧（＋極性または－極性）に保たれているため、信号線ドライバ16、液晶表示パネル12、およびコモン電圧発生部11においては、より消費電力の低減効果が大きくなる。しかしながら、この方法においては、＋書込みと－書込みが画面全体に行われるため、面フリッカの発生が考えられる。

【0056】そこで、図7（A）および（B）に示すように、入力画像情報を倍速処理し、次サブフィールドのデータ群をメモリに記録すると共に、他方のサブフィールドのデータ群の書込みをSF1で行う。例えば、この際の書込みに関しては＋極性で行う。引き続き、SF2期間中に前記メモリへ記録したデータ群の書込みを、前記サブフィールドと極性を反転し－極性で書込む。このサブフィールド期間は、通常のマルチフィールド駆動の半分の期間によって行われるため、面フリッカは高い周波数領域に入り、視認されない。この場合、ゲート線駆動回路13のクロック部での消費電力が増えるが、コモン電圧発生部11での消費電力が大幅に低減されるた

め、全体としては消費電力が低くなる。

【００５７】上記処理は、図１に示すｎ：ｍインターレース処理回路１４内にメモリを設け、そのメモリを用いて行ってもよい。ここでは、簡単に説明を行うために、ｎ：ｍインターレース処理回路１４内でのバッファーおよび信号線ドライバ内でのバッファーによる信号のタイミングのずれについては特に触れていないが、実際には所望の画像が得られるように、走査線とのタイミングを一致させている。

【００５８】また、メモリを有することによるＩＣ数の増加、消費電力の増加が予想されるが、図８に示すように、信号を出力するコンピュータ側からの信号出力を制御することによって、モジュール内にメモリを有しない構成にすることができる。通常、情報端末本体中には、ビデオＲＡＭ２１およびコントロール回路２２によってモジュールへの信号出力を制御している。本実施例では、ｎ：ｍインターレースの処理手段に応じて、入力画像を変換するため、このコントロール回路２２にモジュール回路の走査線選択信号Ｓ１を走査線選択信号発生回路２８から入力する。そして、コントロール回路２２は、ビデオＲＡＭ２１との間でアドレスの指定および画像の出力タイミングを変えることになる。なお、図８において、参照番号２３～２７は、それぞれ液晶表示パネル、ｎ：ｍインターレース処理回路、信号線ドライバ、ｎカウンター回路、ゲート線駆動回路を示し、これらの機能は図１に示す場合と同じである。

【００５９】さらに、本実施例においては、コモン電圧の反転周期を大幅に低くできるため、極性反転時でのコモン電圧の立ち上がりが問題とならないようにすることができる。すなわち、ブランキング期間中にコモン電圧の極性を反転させればよいため、書込み時におけるコモン電圧の時定数を比較的長くとることになる。したがって、対向電極のシート抵抗が大きくすることができる。あるいは給電点を少なくすることができる。

【００６０】上記駆動方法は、２ｎ＋１：１（ｎ≧１）マルチフィールド駆動を倍速処理する場合において特に有効であるが、上記実施例に制限されるものではない。

【００６１】（実施例２）実施例２においては、サブフィールドで選択する画素もしくは走査線の間隔を、各サブフィールド間で同一にし、画素もしくは走査線の選択または非選択の周期に対して極性の反転周期を不一致とすると共に、フィールド間でも極性の反転周期を不同一とする。

【００６２】図９は、本発明の他の駆動方法に係る信号と、その信号により液晶表示パネルに表示される画像を示す。図９中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【００６３】ここでは、マルチフィールド駆動において、ｎ＝５、ｍ＝２（サブフィールド数は２．５となるが、表示画像としては３枚のサブフィールドによって構成されている）を用いた場合であり、駆動周波数を低減させることができ、信号線ドライバ１６、ゲート線駆動回路１３、液晶表示パネル１２、およびコモン電圧発生部１１における消費電力を低減することができる。この場合、極性の反転方法を３走査線毎と２走査線毎に同じ極性とする反転を交互に行い、さらに次フィールドで選択を行う１つ下の走査線は、隣接して同じ極性となる走査線群が最少となるように上の走査線と逆極性となるように書込みを行っている。このようにすることにより、マルチフィールド駆動法を採用した場合でも、隣接して同じ極性となる走査線を２本以下にすることができ、さらに空間周波数を高くすることができる。

【００６４】しかしながら、この方法においては、＋書込みと－書込みが画面内において３：２の割合で偏って存在するため、液晶材料および配向膜に直流成分が印加されることが予想される。そこで、数サブフィールド毎に＋書込みと－書込みの走査線数の割合を切り換える。この場合、切り換え時の面フリッカが視認される恐れがあると考えられるが、視覚特性で視認されない切り換え周波数（例えば１［Ｈｚ］）以下に下げることによって、画質劣化を低減することができる。また、極性の偏りに合わせて最適となるコモン電圧をコモン電圧発生部１１より出力するようにしてもよい。

【００６５】図１０は図９の走査線の選択方法の変更例を示しており、図９と同様に本発明の駆動方法に係る信号およびその信号により液晶表示パネルに表示される画像を示す。図１０に示す駆動方法において、サブフィールド中において、連続して２つの走査線を駆動していない。なお、図１０中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【００６６】ここでも、マルチフィールド駆動において、ｎ＝５、ｍ＝２（サブフィールド数は２．５となるが、表示画像としては３枚のサブフィールドによって構成されている）を用いた場合であり、駆動周波数を低減することができ、信号線ドライバ１６、ゲート線駆動回路１３、液晶表示パネル１２、およびコモン電圧発生部１１における消費電力を低減することができる。この場合も、極性の反転方法を３走査線毎と２走査線毎で同じ極性とする反転を交互に行い、さらに次フィールドで選択を行う１つ下の走査線は、隣接して同じ極性となる走査線群が最少となるように上の走査線と逆極性となるように書込みを行っている。

【００６７】このようにすることにより、マルチフィールド駆動法を採用した場合でも、隣接して同じ極性とな

る走査線を２本以下にすることができ、さらに空間周波数を高くすることができる。さらに、この方法においては、＋書込みと－書込みが走査線毎で３：２の割合で偏って存在しているが、画面内において平均化されており、図９の場合に比べて、配向膜に直流成分が印加しないと考えれる。

【００６８】この場合も、図９に示す場合と同様に、数サブフィールド毎に＋書込みと－書込みの走査線数の割合を切り換えてもよい。この駆動方法は、２ｎ＋１：２（ｎ≧１）マルチフィールド駆動において特に有効であるが、上記実施例に制限されるものではない。

【００６９】（実施例３）実施例３においては、極性の反転周期に対し、サブフィールドにおいて選択する画素もしくは走査線の間隔を変える。

【００７０】図１１は、本発明の他の駆動方法に係る信号と、その信号により液晶表示パネルに表示される画像を示す。図１１中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【００７１】ここでは、マルチフィールド駆動において、ｎ＝６、ｍ＝２（サブフィールド数は３）を用いた場合であり、駆動周波数を低減させることができ、信号線ドライバ１６、ゲート線駆動回路１３、液晶表示パネル１２、およびコモン電圧発生部１１における消費電力を低減することができる。

【００７２】この駆動方法を用いた場合、隣接して同じ極性となる走査線数がｎ本以下にならない部分が生じる。しかしながら、図１１に示すように、横縞の間隔が変化し、また横縞流れも無くなるので、横縞の空間スペクトルが分散されて視認され難くなり、同時に折り返し歪に対しても有効である。

【００７３】（実施例４）実施例４においては、極性の反転周期に対し、サブフィールドにおいて選択する画素もしくは走査線の間隔を変えると共に、各サブフィールド間で不同一とする。

【００７４】図１２は、本発明の他の駆動方法に係る信号と、その信号により液晶表示パネルに表示される画像を示す。図１２中、斜線部は＋極性を示し、無地部は－極性を示し、また、対角線を付した部分は各サブフィールドで選択した走査線を示す。ここで、対角線を付していない非選択走査線の極性は、各走査線を最後に選択した際の極性が維持されている。

【００７５】ここでは、マルチフィールド駆動において、ｎ＝３、ｍ＝１（サブフィールド数は３）を用いた場合であり、駆動周波数を低減させることができ、信号線ドライバ１６、ゲート線駆動回路１３、液晶表示パネル１２、およびコモン電圧発生部１１における消費電力を低減することができる。

【００７６】この駆動方法においては、ＳＦ１～ＳＦ６で走査線の選択順位を同じにし、＋極性および－極性をサブフィールド間で反転する。続くＳＦ７～ＳＦ１２で前記とは異なる選択順位にし、サブフィールド間で極性を反転させている。同様にしてＳＦ１３～ＳＦ１８も行い、走査線の選択順位が同一とならない部分を含めている。このようにすることにより、ある一定の選択順位で駆動した場合に生じる横縞または横縞流れに対し、視認され難くすることができる。

【００７７】（実施例５）実施例５は、上記の各実施例において、保持期間中の極性反転方法を変えることによって画質を向上させる応用例である。

【００７８】マルチフィールド駆動において、走査線を非選択する期間は書込み動作を行わないため、信号線電圧およびコモン電極電圧を変えたとしても、理論的には画素電極がフローティング状態にあり、このため、液晶層にかかる電界は一定に保たれている。しかしながら、実際には、スイッチング素子であるＴＦＴのスイッチング特性および液晶材料の特性によって、リーク電流が発生し、画素電極電位が変化する。この場合、保持期間中の極性反転を制御することによって、リークによる画素電位変動及び輝度変化を改善することができる。

【００７９】ここでは、マルチフィールド駆動において、ｎ＝４、ｍ＝１（サブフィールド数は４÷１＝４）を用いた場合であり、通常－書込み時（－）の保持特性は、＋書込み時（＋）の保持特性に比べリーク電流が大きいため、保持期間中の極性に関して、例えば図１３に示すように、－書込み時の電圧が信号線に印加されるようにしておく。この図においては、分かりやすくするために、信号線Ｘｎ、Ｘｎ＋１に印加する電圧値は、コモン電位（Ｖcom）に対する電圧を示してある。この場合の電圧値Ｖ０については特に制限はないが、＋書込み時と－書込み時の保持特性が等しくなるようにしておくことが好ましい。

【００８０】この場合、処理としては、走査線選択信号Ｓ１を信号線ドライバ１６に入力し、非選択期間中信号線ドライバ１６内で作られたＶ０を信号線へ出力することによって実施する。なお、Ｖ０はＤ０を基にして与えてもよい。この例に限らず、保持期間中のスイッチング特性を向上させるために、保持期間中の極性の反転周期を種々変えることができる。

【００８１】さらに、コモン電圧の極性に関しては、コモン電極の抵抗が高く、時定数が長くなることによる立ち上がり時の波形の鈍りを改善するため、図１４に示すように、保持期間中に次の書込み時の極性へ反転させることによって、書込み時にはコモン電圧の波形が完全に立ち上がった状態で行われるようにすることができる。例えば、図１５（Ａ）に示すように、ウインドウ表示を行った場合、図１５（Ｂ）に示すように、ウインドウ左右にコントラストの異なる部分が生じ、クロストークに

よる画質劣化が生じる。

【００８２】例えば、ウインドウ内に黒を表示し、ウインドウ外に中間調を表示した場合、ウインドウ左右の中間調は、その外の部分に比べ明るくなる。これは、図１９に示すように、信号線とコモン電極間の容量カップリングによって、ウインドウの無い走査線選択期間と、ウインドウの有る走査線選択期間とで、コモン電圧の波形の立ち上がりが異なるためである。このため、書込み時において画素電極への実行電圧に差が生じ、クロストークが現れると考えられる。本実施例によれば、図１６に示すように、コモン電圧の極性反転が通常より充分早く行われるため、コモン電圧の波形の立ち上がりに影響を及ぼすことがない。したがって、クロストークを無くし、画質を大幅に改善することができる。

【００８３】本実施例は４：１マルチフィールド駆動に限られるものではなく、すべてのｎ：ｍマルチフィールド駆動に適用することができる。ここで、本実施例の駆動方法を連続して２ＬＩＮＥの書込み動作を行う実施例２に適用した場合について説明する。

【００８４】連続して書込み動作を行う場合、次走査線の書込み期間でのコモン電極での反転に関し、あらかじめ反転をしておく期間が無いと考えられる（図１７（Ａ））。この場合においても、走査線の選択のタイミングを図１７（Ｂ）に示すようにすることで実施することができる。この場合、ゲート線駆動回路では、シフトレジスタのタイミングを可変できる機能を有しているものとする。図１７（Ｂ）では、クロックによってタイミングを変えるものであり、連続して選択される前の走査線を選択した後、クロックを止め、極性反転を行なった後、充分にコモン電圧が立ち上がってから、クロックを再動作させ信号をシフトさせる。これと共に走査線選択信号でＯＮ信号することによって、連続して選択される後の走査線を選択する。その後は、通常により高速のクロック信号によってシフト動作が行われ、次の走査線の選択動作に合わせる。

【００８５】また、極性の反転周期と同期させて、書込み期間を長くすることもできる。例えば、図１８（Ｂ）に示すように、走査線の選択期間を通常より長くすることによって、書込み特性を上げることができ、画質を大幅に改善することができる。この場合、走査線選択信号発生回路１８およびゲート線駆動回路１３における処理は、例えば図１８（Ａ）に示すようになっているものとする。

【００８６】ここでは、４：１マルチフィールド駆動法において説明している。すなわち、走査線選択信号からは、４つの走査線選択信号Ｓ１０，Ｓ１１，Ｓ１２，Ｓ１３が出力されており、それぞれが走査線Ｇ４ｎ、Ｇ４ｎ＋１、Ｇ４ｎ＋２、Ｇ４ｎ＋３の出力制御を行うものである。この場合、Ｓ２からの信号は、単にマルチフィールド駆動とＨ反転を組み合わせた場合の信号に対して４倍の走査線選択期間を有する信号として出力される。ここで、信号線ドライバ１６からは所望の画像を表示する信号が信号線に出力されているものとする。

【００８７】本発明は上記実施例に限定されるものではなく、その要旨を逸脱しない範囲で種々変形して実施することが可能である。

【００８８】

【発明の効果】本発明の液晶表示装置は、少なくとも一方の基板上に、Ａ個の画素もしくは走査線、および前記画素または走査線を選択するスイッチング素子を有する一対の基板と、前記一対の基板間に挟持された液晶材料と、選択された走査線について、同一の走査線に配列した画素群に対して同じ極性で駆動させる駆動手段と、前記極性を反転させてフリッカを補償する極性反転手段とを具備し、表示領域が、１枚のフレーム画像を時間軸に沿って順に表示するｎ個のサブフィールドに分割され、前記サブフィールドがＡ÷ｎ×ｍ（ここで、Ａは正の整数、ｎは３～Ａの正の整数、ｍはｎ以下の正の整数）個の画素または走査線で基本的に構成されており、前記サブフィールドにおいて前記画素または走査線を所定の間隔で選択するので、クロストーク等の画質劣化を防止できる。

【００８９】また、本発明によれば、画素または走査線の選択もしくは非選択の周期と、極性反転の周期を同期させないことによって、隣接して同じ極性となる画素または走査線の数が小さくでき、それに起因する横縞妨害を視認され難くできる。さらに、時間軸に沿って横縞が流れなくなるため、視覚特性より画質を大幅に改善することができる。

【００９０】また、本発明によれば、書込み動作を通常の倍速で行い、極性反転をサブフィールド毎に行うことによって、画質を劣化させることなく、コモン電極での消費電力を大幅に低減することができる。

【００９１】また、本発明によれば、保持期間中の極性反転周期を変えることによって、ＴＦＴおよび液晶層によるリーク電流を制御すると共に、＋書込みと－書込みでの保持特性を等しくし、画質を大幅に改善することができる。さらに、コモン電極においては、保持期間中に次の書込み時の極性へ反転させることによって、コモン電極が所望の電圧に立ち上がった状態で書込み動作を行うことができるので、書込み特性を最適化でき画質を大幅に改善することができる。

【００９２】また、本発明によれば、極性の反転周期に合わせて書込み期間を長くとることによって、画素電極への書込み特性を向上させ、画質を大幅に改善することができる。

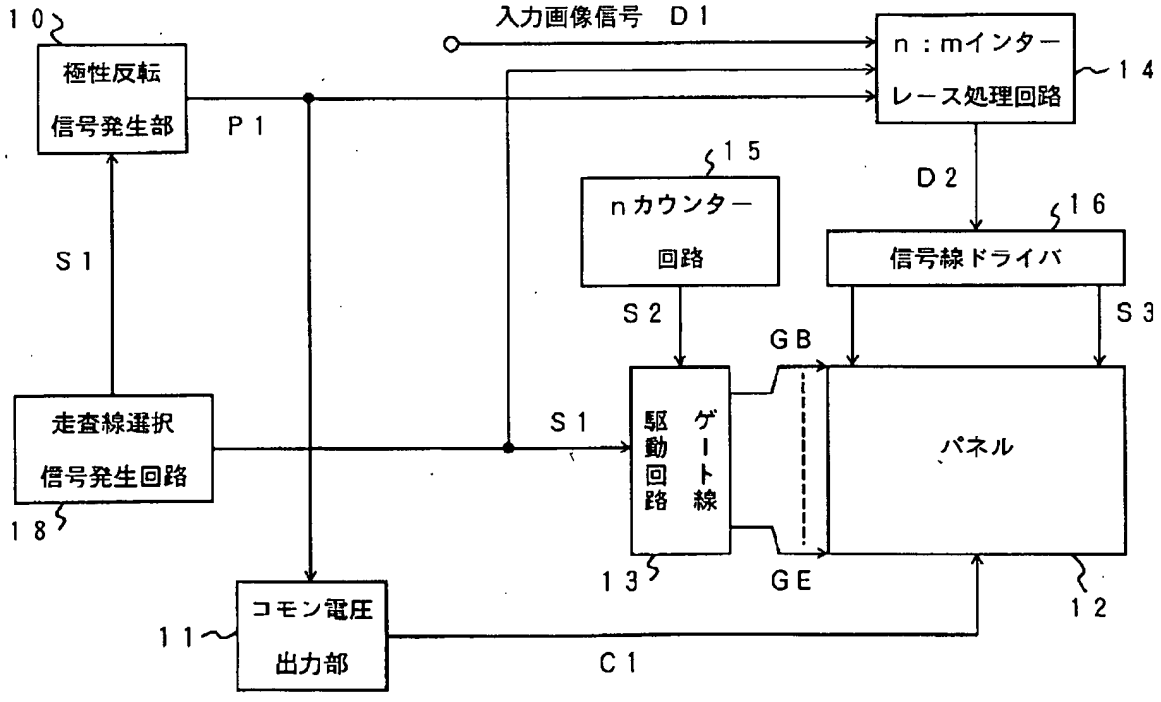
【図面の簡単な説明】

【図１】本発明の液晶表示装置の要部の構成を示すブロック図。

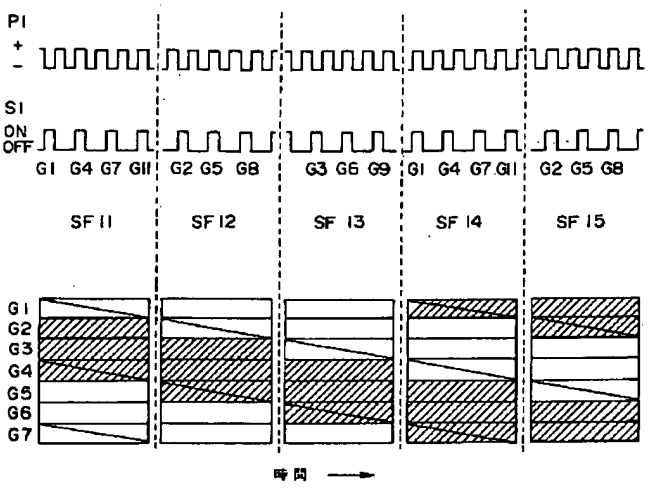
【図２】本発明の駆動方法を用いた際の信号波形と極性

分布を示す図。
【図3】液晶の電圧－透過率曲線を示す図。
【図4】（A）はn：mインターレース処理回路の処理内容を説明するための図、（B）は各部の信号波形を示す図。
【図5】実施例1において、4：1マルチフィールド駆動の信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図6】実施例1において、5：1マルチフィールド駆動の信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図7】（A）および（B）は5：1マルチフィールド駆動の倍速書込み駆動における回路の処理内容を示すブロック図。
【図8】本発明の液晶表示装置における画像信号の変換処理の構成を示すブロック図。
【図9】実施例2において、5：2マルチフィールド駆動の信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図10】実施例2の変更例としての信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図11】実施例3の信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図12】実施例4の信号波形図と本発明の駆動方法を用いた際の極性分布を示す図。
【図13】実施例5の信号波形を示す図。
【図14】実施例5の変更例として、リーク特性を補償するための信号波形図。
【図15】（A）および（B）はウインドウ表示によるクロストークを示す表示画像図。
【図16】本発明の駆動方法を行った場合におけるウインドウ表示時での各部の信号波形図。
【図17】（A）および（B）は実施例5の変更例にかかる走査線の選択方法および極性の反転方法を示す信号波形図。
【図18】（A）は実施例5の変更例にかかる処理構成を示す図、（B）は実施例5の変更例にかかる走査線および極性の反転周期を示す信号波形図。
【図19】従来の駆動方法を行った場合におけるウインドウ表示時での各部の信号波形図。
【符号の説明】
10…極性反転信号発生部、11…コモン電圧出力部、12，23…液晶表示パネル、13，27…ゲート線駆動回路、14，24…n：mインターレース処理回路、15，26…nカウンター回路、16，25…信号線ドライバ、18，28…走査線選択信号発生回路、21…ビデオRAM、22…コントロール回路、31，32…セレクター。

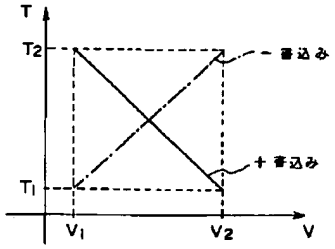
【図1】



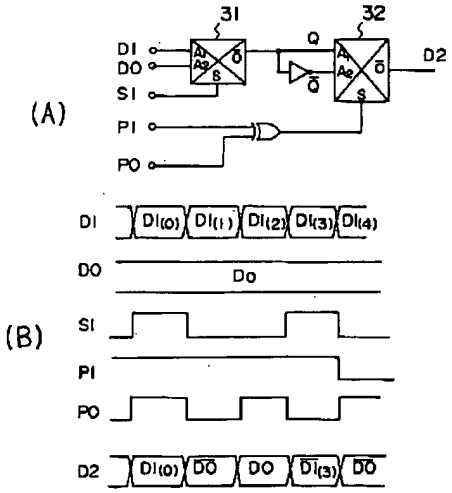
【図2】



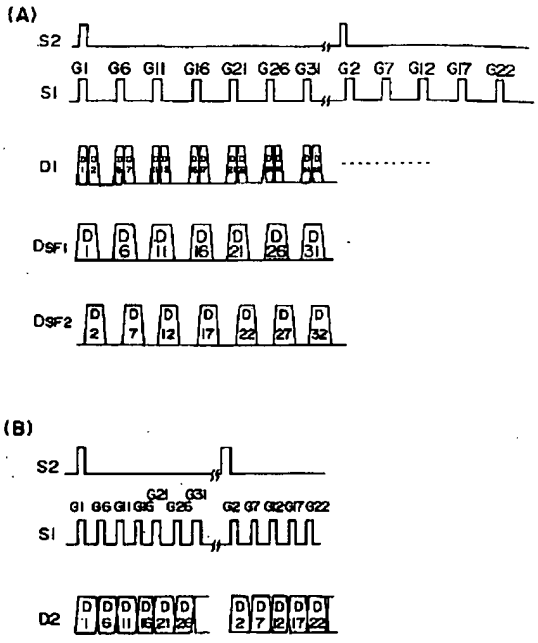
【図3】



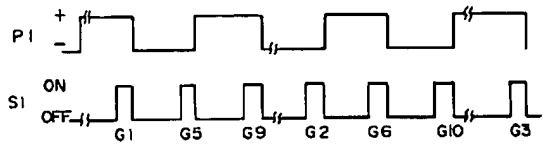
【図4】



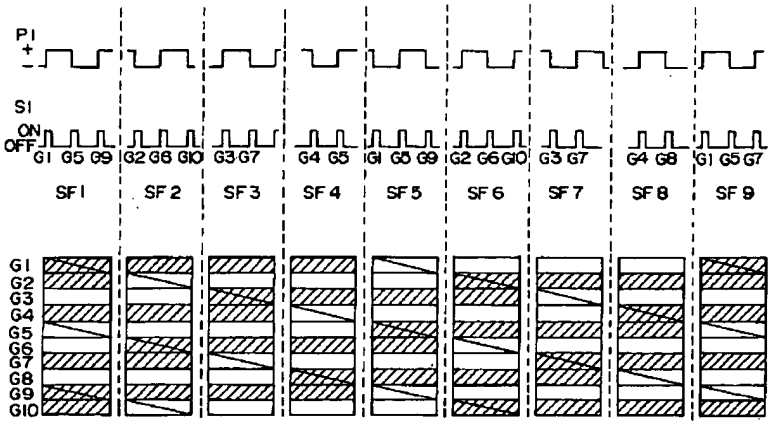
【図7】



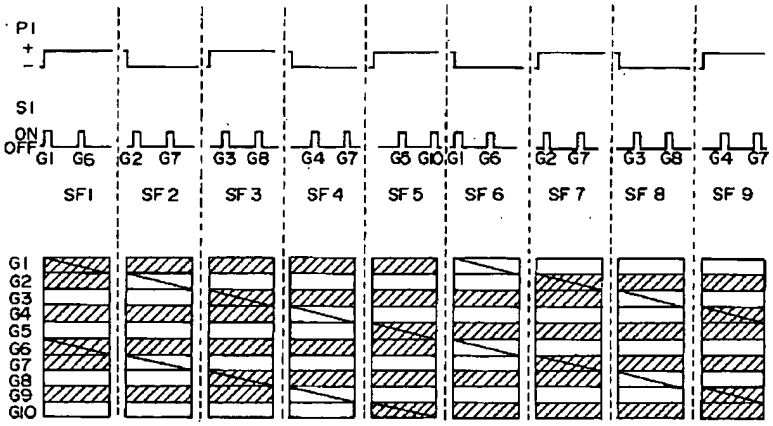
【図14】



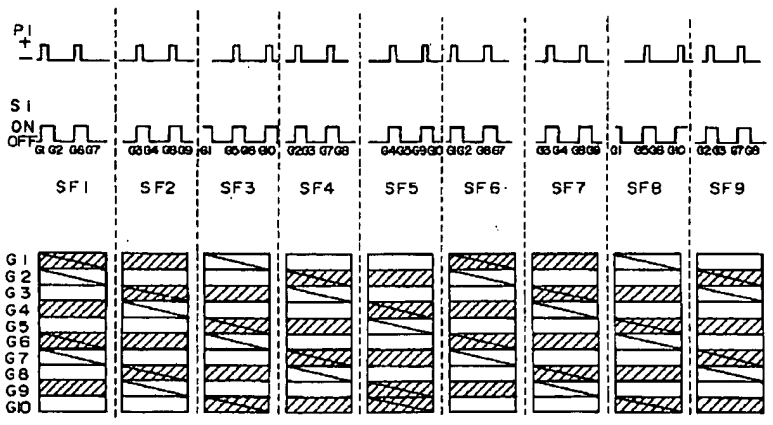
【図5】


PI
SI
ON
OFF
G1 G5 G9
G2 G6 G10
G3 G7
G4 G5
G1 G5 G9
G2 G6 G10
G3 G7
G4 G8
G1 G5 G7
SF1
SF2
SF3
SF4
SF5
SF6
SF7
SF8
SF9
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10

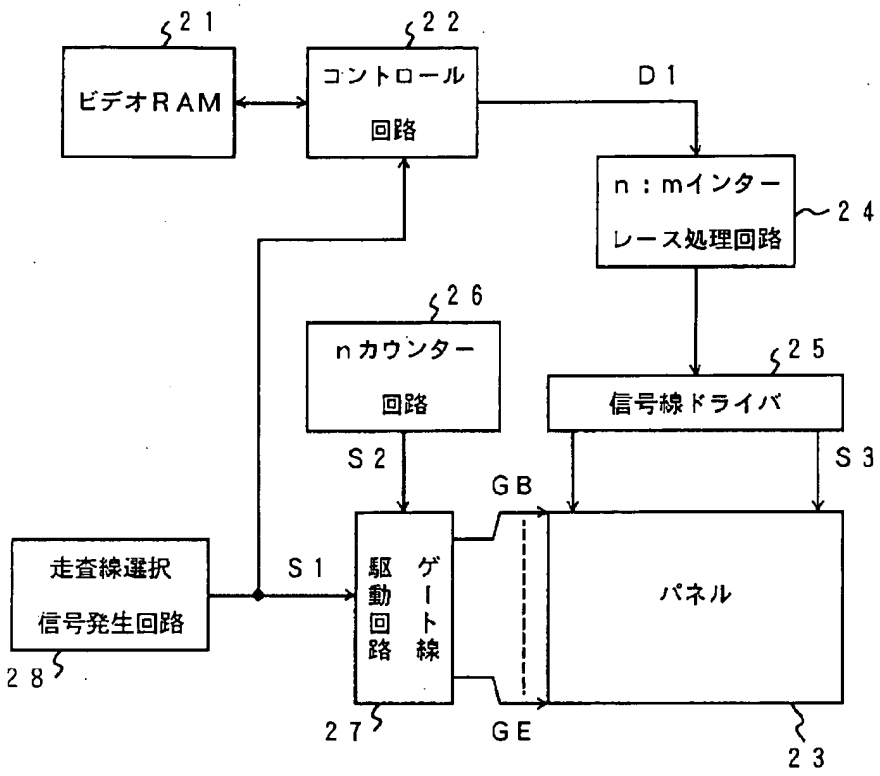
【図6】


PI
SI
ON
OFF
G1 G6
G2 G7
G3 G8
G4 G7
G5 G10
G1 G6
G2 G7
G3 G8
G4 G7
SF1
SF2
SF3
SF4
SF5
SF6
SF7
SF8
SF9
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10

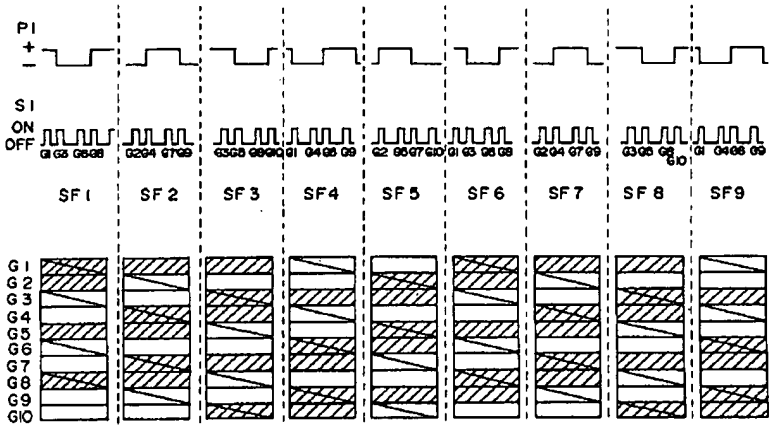
【図9】


PI
SI
ON
OFF
SF1
SF2
SF3
SF4
SF5
SF6
SF7
SF8
SF9
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10

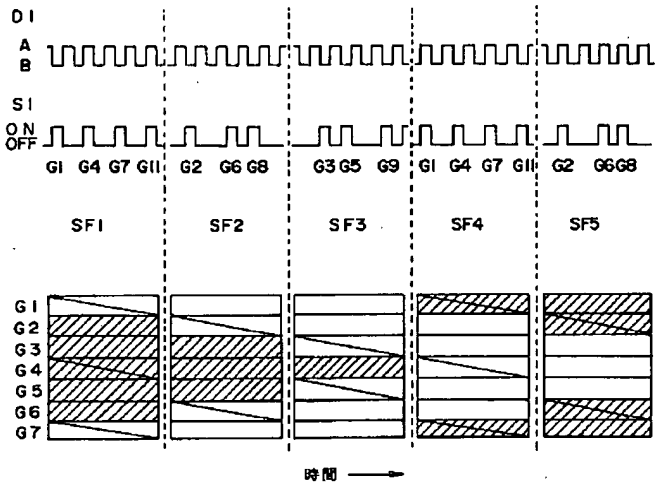
【図8】


21
ビデオRAM
22
コントロール
回路
D1
n：mインター
レース処理回路
24
26
nカウンター
回路
25
信号線ドライバ
S2
S3
GB
走査線選択
信号発生回路
S1
駆動回路
ゲート線
パネル
28
27
GE
23

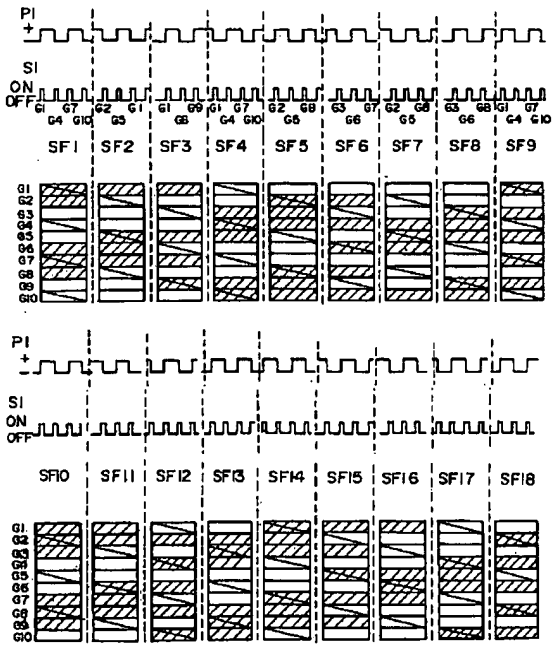
【図10】


PI
SI
ON
OFF
SF1
SF2
SF3
SF4
SF5
SF6
SF7
SF8
SF9
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10

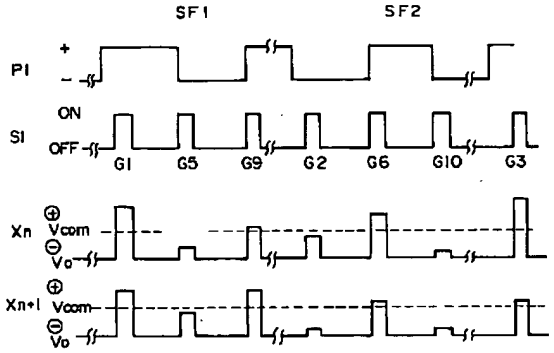
【図１１】


DI
A
B
SI
ON
OFF
G1 G4 G7 G11 G2 G6 G8 G3 G5 G9 G1 G4 G7 G11 G2 G6 G8
SF1 SF2 SF3 SF4 SF5
G1
G2
G3
G4
G5
G6
G7
時間

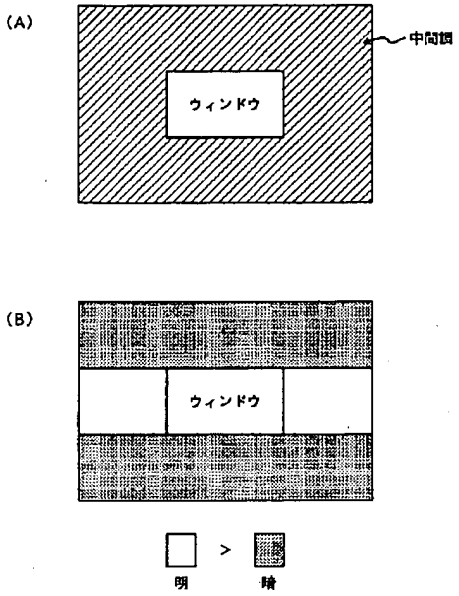
【図１２】


PI
SI
ON
OFF
SF1 SF2 SF3 SF4 SF5 SF6 SF7 SF8 SF9
SF10 SF11 SF12 SF13 SF14 SF15 SF16 SF17 SF18

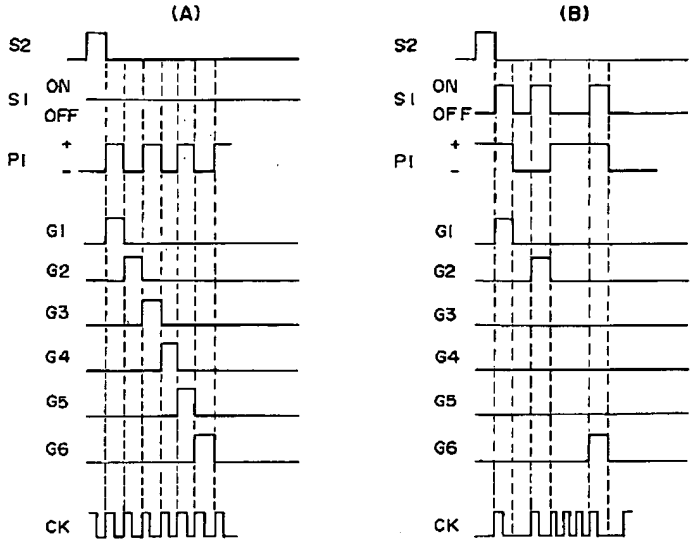
【図１３】


SF1
SF2
PI
SI
ON
OFF
G1 G5 G9 G2 G6 G10 G3
Xn
Xn+1
Vcom
Vo

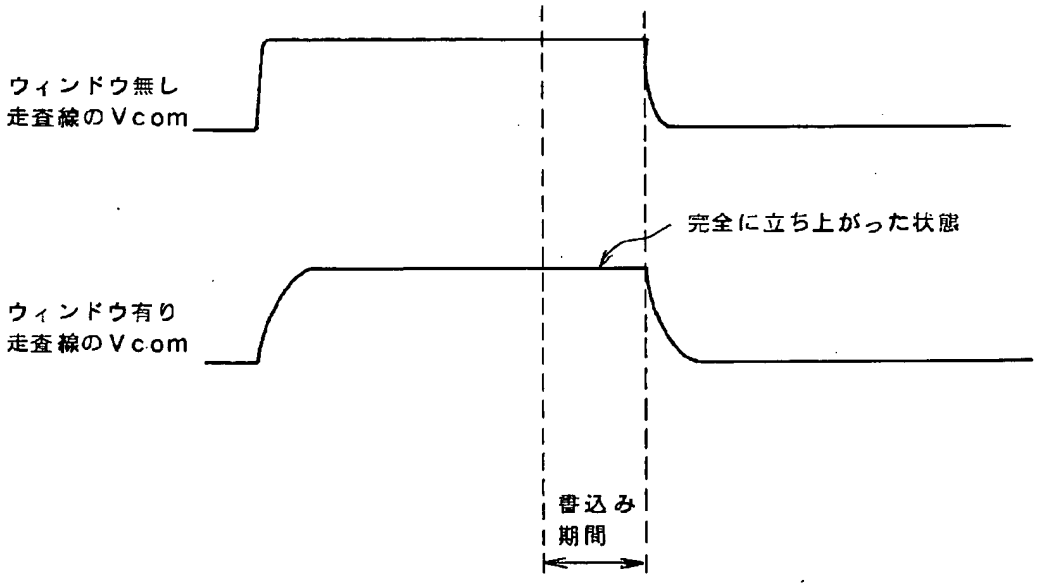
【図15】


(A)
中間調
ウィンドウ
(B)
ウィンドウ
>
明
暗

【図17】

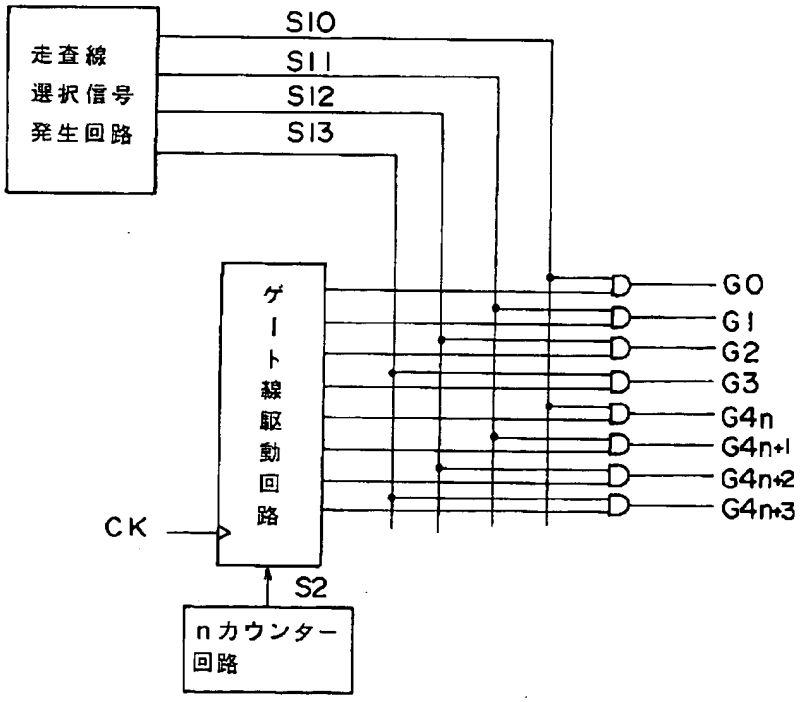

(A)
(B)
S2
S1
ON
OFF
PI
+
-
G1
G2
G3
G4
G5
G6
CK

【図16】

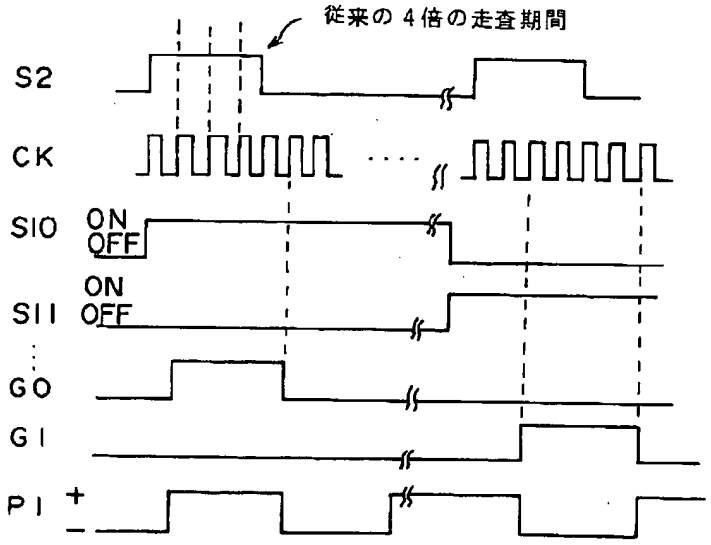

ウィンドウ無し
走査線のVcom
完全に立ち上がった状態
ウィンドウ有り
走査線のVcom
書込み
期間

【図18】

(A)


走査線
選択信号
発生回路
S10
S11
S12
S13
ゲート線駆動回路
CK
S2
nカウンター回路
G0
G1
G2
G3
G4n
G4n+1
G4n+2
G4n+3

(B)


従来の4倍の走査期間
S2
CK
S10
ON
OFF
S11
ON
OFF
G0
G1
P1
+
−

【図19】